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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facililties (air).

For related information see also *Astronautics.*

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For related information see also *34 Fluid Mechanics and Heat Transfer.*

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For related information see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance.* For space suits see *54 Man/System Technology and Life Support.*

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Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS 1092
Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 1092
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 1092
Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW, POLITICAL SCIENCE AND SPACE POLICY N.A.
Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1094
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) 1094

89 ASTRONOMY 1099
Includes radio, gamma-ray, and infrared astronomy; and astrometry.

90 ASTROPHYSICS 1100
Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics.*

91 LUNAR AND PLANETARY EXPLORATION 1100
Includes planetology; and manned and unmanned flights.
For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

92 SOLAR PHYSICS 1102
Includes solar activity, solar flares, solar radiation and sunspots.
For related information see *93 Space Radiation.*

93 SPACE RADIATION 1104
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs.

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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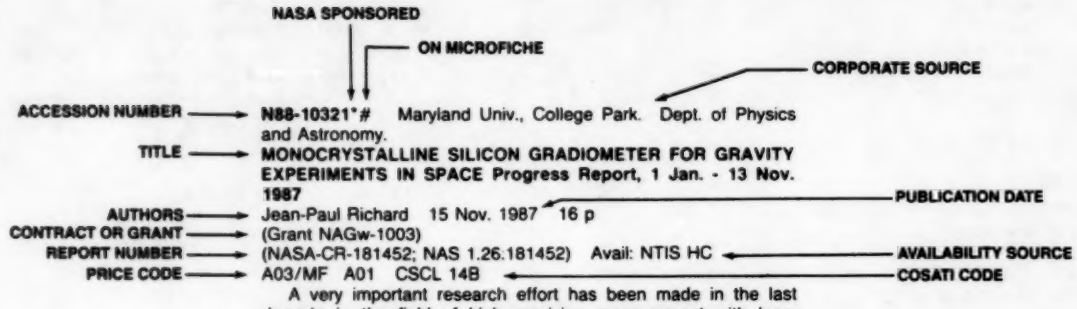
CONTRACT NUMBER INDEX I-71
REPORT/ACCESSION NUMBER INDEX I-73

TYPICAL CITATION AND ABSTRACT



A very important research effort has been made in the last decade in the field of high precision measurement with laser instrumentation. The development of a space borne gradiometer operating at a high sensitivity level using laser measurement of the distance between proof mass over a short base line of order one meter is discussed. Two aspects of laser technology make it a promising tool for gradiometry measurements: quantum limited accuracy and absolute distance measurements. The quantum limit associated with laser instrumentation was formulated. The relevant quantum and classical sources of errors in laser measurements were reviewed and corresponding laser performance requirements for gradient measurements were evaluated. Some mechanical quality factor measurements were made on simple resonant monocrystalline silicon suspensions. It was discovered that the use of zero derivative restoring forces to position the gradiometer test masses will dramatically reduce the gradiometer temperature control requirements. A laser beam side injection scheme was discovered which permits rejection of common mode accelerations. These concepts are briefly discussed. Author

VOLUME 26 NUMBER 8/ APRIL 23, 1988

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N88-15757# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACTA AERODYNAMICA SINICA (SELECTED ARTICLES)
2 Sep. 1987 119 p 3ransl. into ENGLISH from Kongqidonglixue Xuebao (China), v. 4, no. 2, Jun. 1986 p 140-192 and 218-225
(AD-A185723; FTD-ID(RS)T-0116-87) Avail: NTIS HC A06/MF A01 CSCL 01A

The following topics are addressed: Semi-numerical method to treat the three-dimensional stokes flow; A new technique of numerical conformal mapping and its applications; Numerical solution of transonic small disturbance pressure equations using a mixed difference method; Incompressible theory of the interaction between moving bodies and vorticity field - The generation of vorticity by body surfaces and its dissipation; A strong inviscid-viscous interaction solution of a plane transonic cascade flow; and Numerical calculations of inviscid transonic flows over wings. GRA

N88-15758* National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING. A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 221
Jan. 1988 124 p
(NASA-SP-7037(221); NAS 1.21:7037(221)) Avail: HC A06; NTIS standing order as PB88-914100, $8.50 domestic, $17.00 foreign CSCL 01A

This bibliography lists 409 reports, articles, and other documents introduced into the NASA scientific and technical information system in December, 1987. Author

N88-15759# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
SUPPORTABILITY IN AIRCRAFT SYSTEMS THROUGH TECHNOLOGY AND ACQUISITION STRATEGY APPLICATIONS M.S. Thesis
Debra L. Haley Sep. 1987 82 p
(AD-A186465; AFIT/GLM/LSM/87S-30) Avail: NTIS HC A05/MF A01 CSCL 15E

The importance of high reliability systems in the national defense strategy of force multiplier is paramount. Currently, the Air Force has adopted Reliability and Maintainability (R&M) 2000 as a management policy to achieve high reliabilities. However, there are few methods being implemented which can improve the measures of reliability. One method used with success by satellite systems is the use of expensive, but highly reliable class S electronic parts as opposed to the class B parts used in avionics and ground electronic systems. A method for determining the improvement of systems' Mean Time Between Failure (MTBF) was developed. Additionally, the impact of improved system MTBF along with higher acquisition costs as a result of using class S parts was analyzed in a life cycle cost model. Results obtained in this research indicate that class S parts have the potential of significantly increase MTBF while actually lowering life cycle costs. Recommendations for follow-on research are given. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N88-15760*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
UNSTEADY TRANSONIC ALGORITHM IMPROVEMENTS FOR REALISTIC AIRCRAFT APPLICATIONS
John T. Batina Dec. 1987 15 p Presented at the 26th AIAA Aerospace Sciences Meeting, Reno, Nev., 11-14 Jan. 1988
(NASA-TM-100516; NAS 1.15:100516; AIAA-88-0105) Avail: NTIS HC A03/MF A01 CSCL 01A

Improvements to a time-accurate approximate factorization (AF) algorithm were implemented for steady and unsteady transonic analysis of realistic aircraft configurations. These algorithm improvements were made to the CAP-TSD (Computational Aeroelasticity Program - Transonic Small Disturbance) code developed at the Langley Research Center. The code permits the aeroelastic analysis of complete aircraft in the flutter critical transonic speed range. The AF algorithm of the CAP-TSD code solves the unsteady transonic small-disturbance equation. The algorithm improvements include: an Engquist-Osher (E-O) type-dependent switch to more accurately and efficiently treat regions of supersonic flow; extension of the E-O switch for second-order spatial accuracy in these regions; nonreflecting far field boundary conditions for more accurate unsteady applications; and several modifications which accelerate convergence to steady-state. Calculations are presented for several configurations including the General Dynamics one-ninth scale F-16C aircraft model to evaluate the algorithm modifications. The modifications have significantly improved the stability of the AF algorithm and hence the reliability of the CAP-TSD code in general. Author

N88-15761*# Waterloo Univ. (Ontario). Dept. of Applied Mathematics.
UNSTEADY THREE-DIMENSIONAL FLOW SEPARATION Contract Report, 1986-1988
W. H. Hui Feb. 1988 50 p
(Grant NAGw-575)
(NASA-CR-182412; NAS 1.26:182412) Avail: NTIS HC A03/MF A01 CSCL 01A

A concise mathematical framework is constructed to study the topology of steady 3-D separated flows of an incompressible, or a compressible viscous fluid. Flow separation is defined by the existence of a stream surface which intersects with the body surface. The line of separation is itself a skin-friction line. Flow separation is classified as being either regular or singular, depending respectively on whether the line of separation contains only a finite number of singular points or is a singular line of the skin-friction field. The special cases of 2-D and axisymmetric flow separation are shown to be of singular type. In regular separation it is shown that a line of separation originates from a saddle point of separation of the skin-friction field and ends at nodal points of separation. Unsteady flow separation is defined relative to a coordinate system fixed to the body surface. It is shown that separation of an unsteady 3-D incompressible viscous flow at time

t, when viewed from such a frame of reference, is topologically the same as that of the fictitious steady flow obtained by freezing the unsteady flow at the instant t. Examples are given showing effects of various forms of flow unsteadiness on flow separation. Author

N88-15762*# Sverdrup Technology, Inc., Cleveland, Ohio.
CONSISTENT BOUNDARY CONDITIONS FOR REDUCED NAVIER-STOKES (RNS) SCHEME APPLIED TO 3-DIMENSIONAL INTERNAL VISCOUS FLOWS Final Report
D. R. Reddy and S. G. Rubin Jan. 1988 20 p Presented at the 26th Aerospace Science Meeting, Reno, Nev., 11-14 Jan. 1988; sponsored by AIAA Prepared in cooperation with Cincinnati Univ., Ohio
(Contract NAS3-24105)
(NASA-CR-180874; E-3739-1; NAS 1.26:180874; AIAA-88-0714)
Avail: NTIS HC A03/MF A01 CSCL 01A

A consistent and efficient set of boundary conditions is developed for the multi-sweep space-marching pressure-elliptic Reduced Navier-Stokes (RNS) scheme as applied for 3-D internal viscous flow problems. No-slip boundary conditions are directly imposed on the solid walls. There is no iteration procedure required in the cross plane to ensure mass conservation across each marching plane. The finite difference equations forming the coefficient matrix are ordered such that the surface normal velocity is specified on all the solid walls; unlike external flows, a pressure boundary condition in the cross plane is not required. Since continuity is directly satisfied at all points in the flow domain, the first order momentum equations can be solved directly for the pressure without the need for a Poisson pressure correction equation. The procedure developed herein can also be applied with periodic boundary conditions. The analysis is given for general compressible flows. Incompressible flow solutions are obtained, for straight and curved ducts of square cross section, to validate the procedure. These solutions are used to demonstrate the applicability of the RNS scheme, with the improved boundary conditions for internal flows with strong interaction, as would be encountered in ducts and turbomachinery geometries. Author

N88-15763# Aix-Marseilles Univ. (France). Inst. de Mecanique Statistique de la Turbulence.
SUPERSONIC BOUNDARY LAYER ON A HEATED WALL Partial Final Report [COUCHE LIMITE SUPERSONIQUE SUR PAROI CHAUFFEE]
C. Carvin, J. F. Debieve, P. Dupont, and M. Elena Apr. 1987 126 p In FRENCH
(Contract DRET-85-135)
(ETN-88-91617) Avail: NTIS HC A07/MF A01

The study, implementation, and assembly of a heated box designed to provide a uniform temperature on the wall of a supersonic wind tunnel is described. The corresponding wind tunnel tests aimed to analyze the physical characteristics of a turbulent supersonic boundary layer at Mach 2.3 when in contact with a heated wall with up to 300 C temperature difference. Measurements were carried out using hot wire anemometers and one dimensional laser velocimeters. The longitudinal velocity fluctuations show little influence of the heated wall. The effects on the Reynolds tension near the wall are more noticeable. ESA

N88-15764# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de l'Aerodynamique.
NACELLE-WING INTERACTIONS (STUDIES 1986) DEVELOPMENT OF A FINITE ELEMENT CODE IN A MULTI-DOMAIN VERSION [INTERACTION NACELLE-VOILURE: TRAVAUX 1986: MISE AU POINT D'UN CODE D'ELEMENTS FINIS DANS UNE VERSION 'MULTIDOMAINES']
J. Marechal Jul. 1987 33 p In FRENCH
(Contract STPA-85-95-009)
(ONERA-RTS-10/3417-AY-308A; ETN-88-91618) Avail: NTIS HC A03/MF A01

A method to compute transonic three dimensional steady flows around a complex configuration is presented. The flow domain is divided in blocs and the finite element networks are defined inside each block. The method involves the solution of the conservative form of the potential equation. The system of discrete equations is linearized using a fixed point method, while the linear problems are solved by a preconditioned conjugate gradient method. The multidomain algorithm is based on differenciating the inner nodes from the interface nodes. The final detailed writing of the different modules and algorithms is not yet finished. ESA

N88-15765# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Numerische Stroemungsmechanick.
THE SIMULATION OF THREE-DIMENSIONAL VISCOUS SUPERSONIC FLOW PAST BLUNT BODIES WITH A HYBRID IMPLICIT/EXPLICIT FINITE DIFFERENCE METHOD
Stefan Riedelbauch and Bernhard Mueller (Aeronautical Research Inst. of Sweden, Bromma.) May 1987 62 p Sponsored in part by the Deutsches Forschungsgemeinschaft, Fed. Republic of Germany
(DFVLR-FB-87-32; ISSN-0171-1342; ETN-88-91692) Avail: NTIS HC A04/MF A01

A finite difference method solving the three-dimensional Navier-Stokes equations is outlined. The hybrid implicit/explicit algorithm is a modification of the implicit scheme of Beam and Warming. Supersonic flow is simulated to verify the code. The results are compared with those of an axisymmetric code and with experiment. According to the experiment the whole flow field is laminar in the considered region. It is shown that the pressure distribution and the temperature or heat flux distributions are well predicted on the body surface. ESA

N88-15766*# Ohio State Univ., Columbus. Dept. of Aeronautical and Astronautical Engineering.
AN EXPERIMENTAL MAPPING OF THE FLOW FIELD BEHIND A GLAZE ICE SHAPE ON A NACA 0012 AIRFOIL M.S. Thesis Final Report
Samuel A. Spring Jan. 1988 84 p
(Grant NAG3-28)
(NASA-CR-180847; NAS 1.26:180847) Avail: NTIS HC A05/MF A01 CSCL 01A

The flow field about a NACA 0012 airfoil with a simulated glaze ice shape was studied. Split hot-film anemometry was used to measure the streamwise velocity component in the upper and lower separation bubbles aft of the glaze ice horns. Velocity profiles were presented as well as the boundary layer momentum and displacement thickness distributions through the bubbles. Data were presented at angles of attack of 0, 2 and 4 deg and clearly showed the large region of reverse flow. A detailed discussion of split hot-film acquisition and data reduction, and possible sources of error has been included. Author

N88-15767*# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
DEVELOPMENT OF DIRECT-INVERSE 3-D METHODS FOR APPLIED AERODYNAMIC DESIGN AND ANALYSIS Semiannual Progress Report, 1 Jul. - 31 Dec. 1987
Leland A. Carlson Feb. 1988 44 p
(Grant NAG1-619)
(NASA-CR-182436; NAS 1.26:182436; TAMRF-5373-88-01)
Avail: NTIS HC A03/MF A01 CSCL 01A

Several inverse methods have been compared and initial results indicate that differences in results are primarily due to coordinate systems and fuselage representations and not to design procedures. Further, results from a direct-inverse method that includes 3-D wing boundary layer effects, wake curvature, and wake displacement are presented. These results show that boundary layer displacements must be included in the design process for accurate results. Author

N88-15768*# Kansas Univ. Center for Research, Inc., Lawrence. Flight Research Lab.
CALCULATION OF SYMMETRIC AND ASYMMETRIC VORTEX SEPERATION ON CONES AND TANGENT OGIVES BASED ON DISCRETE VORTEX MODELS

S. Chin and C. Edward Lan Washington NASA Feb. 1988 92 p
(Grant NsG1-629)
(NASA-CR-4122; NAS 1.26:4122; CRINC-FRL-426-4) Avail: NTIS HC A05/MF A01 CSCL 01A

An inviscid discrete vortex model, with newly derived expressions for the tangential velocity imposed at the separation points, is used to investigate the symmetric and asymmetric vortex separation on cones and tangent ogives. The circumferential locations of separation are taken from experimental data. Based on a slender body theory, the resulting simultaneous nonlinear algebraic equations in a cross-flow plane are solved with Broyden's modified Newton-Raphson method. Total force coefficients are obtained through momentum principle with new expressions for nonconical flow. It is shown through the method of function deflation that multiple solutions exist at large enough angles of attack, even with symmetric separation points. These additional solutions are asymmetric in vortex separation and produce side force coefficients which agree well with data for cones and tangent ogives. Author

N88-15769*# Sverdrup Technology, Inc., Cleveland, Ohio.
A MULTISTAGE MESH GENERATOR FOR SOLVING THE AVERAGE-PASSAGE EQUATION SYSTEM Final Report
Richard A. Mulac Jan. 1988 19 p
(Contract NAS3-24105)
(NASA-CR-179539; E-3928; NAS 1.26:179539) Avail: NTIS HC A03/MF A01 CSCL 01A

One means of numerically simulating the 3-D flow field within a multistage turbomachine is through the solution of the average-passage equation system. One requirement of a current algorithm used to solve this system of equations has been the ability to generate multiple blade row meshes which satisfy specific geometrical constraints. In addition to meeting this criterion, one desires a mesh generation code which requires minimal user input, utilizes variable mesh control parameters, generates diagnostics helpful to the user, and possesses the capability to handle widely varying geometries. A mesh generation code with these features was written and has been used in solving the inviscid form of the average-passing equation system for both ducted and unducted multiple blade row geometries. This paper serves as a user reference guide, with a description of the mesh generation algorithm, a sample input file, and examples of typical meshes generated. Author

N88-15770# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THREE-DIMENSIONAL UNSTEADY FLOW ELICITED BY FINITE WINGS AND COMPLEX CONFIGURATIONS Ph.D. Thesis
Jeffrey C. Ashworth 1987 188 p
(AD-A186464; AFIT/CI/NR-87-142D) Avail: NTIS HC A09/MF A01 CSCL 01A

Studies of 2-D unsteady separated flows demonstrate possible aerodynamic benefits of controlled unsteady flows about airfoil surfaces. However, since all applicable wings are necessarily finite, a thorough understanding of 3-D unsteady flows is essential. Any direct application or modelling of this complex 3-D phenomenon may be somewhat premature until a characteristic data base is established. The spatial and temporal transport, accumulation and dissipation of vorticity on the surface of three wings varying only in sweep angles (forward, straight and aft) were examined using flow visualization and hot wire anemometry. Identical geometric positions were tested on each wing for a variety of dynamic parameters. Each sweep geometry produced distinct, time-dependent, spanwise and chordwise sites for vorticity accumulation into large scale leading edge and wingtip vortices. The wingtip and leading edge vortex interactions produced spanwise flow patterns uncharacteristic of 2-D flows. Wing sweep is a dominant geometric parameter in analyzing the effects of unsteady wingtip flow. An initial investigation into the feasibility of unsteady flow application was performed on a model of the X-29 Forward Swept Wing Technology Demonstrator. This model geometry produces complex flow patterns but may be ideally suited for application of unsteady flow technology. GRA

N88-15957# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
TIME ACCURATE TECHNIQUES USING CHARACTERISTIC FLUX AVERAGING WITH APPLICATION TO UNSTEADY AERODYNAMICS
Ronald Deslandes *In* Von Karman Inst. for Fluid Dynamics, Computational Fluid Dynamics Mar. 1987 47 p (For primary document see N88-15951 08-34)
Avail: NTIS HC A20/MF A01

N88-16239# Centre National d'Etudes Spatiales, Toulouse (France).
LARGE BALLOON DEVELOPMENT AND TRANS-MEDITERRANEAN FLIGHTS
A. Soubrier, G. P. Cecchini (Consiglio Nazionale delle Ricerche, Rome, Italy), and M. Vasquez *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 239-240 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

N88-16504# Joint Publications Research Service, Arlington, Va.
EQUATION OF GRAVITATIONAL-GYROSCOPIC WAVES: ANGULAR POTENTIAL AND ITS APPLICATIONS Abstract Only
S. A. Gabov and Yu. D. Pletner *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 44-45 Transl. into ENGLISH from Zhurnal Vychislitelnoy Matematiki i Matematicheskoy Fiziki (Moscow, USSR), v. 27, no. 1, Jan. 1987 p 102-113 Original language document was announced in IAA as A87-29884 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

N88-16505# Joint Publications Research Service, Arlington, Va.
NUMERICAL ANALYSIS OF MOTION OF SOLID BODIES IN ATMOSPHERE Abstract Only
G. M. Lokhov and S. I. Podzorov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 45-46 Transl. into ENGLISH from Zhurnal Vychislitelnoy Matematiki i Matematicheskoy Fiziki (Moscow, USSR), v. 27, no. 2, Feb. 1987 p 272-285 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N88-15771# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
INFLUENCE OF ENVIRONMENTAL FACTORS ON AIRCRAFT WING PERFORMANCE
Feb. 1987 250 p Lecture series held in Rhode-Saint-Genese, Belgium, 16-20 Feb. 1987
(VKI-LS-1987-03; ISSN-0377-8312; ETN-88-91160) Avail: NTIS HC A11/MF A01

Characterization of meteorological phenomena influencing aircraft operations, the influence of wind shear, rain, ground frost and deicing fluids on aircraft performance, measures against wind shear and other flight hazards, and the effects of environmentally imposed roughness on airfoil performance are discussed. For individual titles, see N88-15772 through N88-15778.

N88-15772# Centre National de Recherches Meteorologiques, Toulouse (France).
CHARACTERIZATION OF METEOROLOGICAL PHENOMENA INFLUENCING AIRCRAFT OPERATIONS
J. P. Chalon *In* Von Karman Inst. for Fluid Dynamics, Influence

of Environmental Factors on Aircraft Wing Performance Feb. 1987 32 p (For primary document see N88-15771 08-03)
Avail: NTIS HC A11/MF A01

Phenomena associated with thunderstorms and presenting a potential hazard for aviation are discussed. The structure of thunderstorm systems, updrafts and energy involved, icing, hail, downdrafts, turbulence, and lightning are described. Difficulties in detecting potential hazards for aviation are reviewed. The deficiencies of the detection methods are pointed out. ESA

N88-15773# Technische Univ., Brunswick (West Germany). Inst. for Flight Guidance and Control.
THE INFLUENCE OF WIND SHEAR, DOWNDRAFT, AND TURBULENCE IN AIRCRAFT PERFORMANCE
Manfred Swolinsky *In* Von Karman Inst. for Fluid Dynamics, Influence of Environmental Factors on Aircraft Wing Performance Feb. 1987 59 p (For primary document see N88-15771 08-03)
Avail: NTIS HC A11/MF A01

Typical aircraft responses to short scale gusts or turbulence and to large scale variations of the mean wind are discussed. The phenomena influence the flight performance and may crucially restrict flight safety, especially in takeoff and landing approach. The analysis indicates that aircraft response to wind shear and downdraft on the one hand and short scale gusts on the other hand is quite different and the operational requirements to cope with it have to discriminate between takeoff and landing approach. Adequate information about the aircraft response in wind shear and downdraft can be obtained only by onboard measurement. ESA

N88-15774*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE POTENTIAL INFLUENCE OF RAIN ON AIRFOIL PERFORMANCE
R. Earl Dunham, Jr. *In* Von Karman Inst. for Fluid Dynamics, Influence of Environmental Factors on Aircraft Wing Performance Feb. 1987 14 p (For primary document see N88-15771 08-03)
Avail: NTIS HC A11/MF A01 CSCL 01C

The potential influence of heavy rain on airfoil performance is discussed. Experimental methods for evaluating rain effects are reviewed. Important scaling considerations for extrapolating model data are presented. It is shown that considerable additional effort, both analytical and experimental, is necessary to understand the degree of hazard associated with flight operations in rain. ESA

N88-15775# Boeing Commercial Airplane Co., Seattle, Wash.
EFFECTS OF WING SIMULATED GROUND FROST ON AIRCRAFT PERFORMANCE
Thomas A. Zierten and Eugene G. Hill *In* Von Karman Inst. for Fluid Dynamics, Influence of Environmental Factors on Aircraft Wing Performance Feb. 1987 36 p (For primary document see N88-15771 08-03)
Avail: NTIS HC A11/MF A01

The results of flight test programs of the B737, 757, and 767 aircraft with simulated ground frost contamination are reviewed. A frost of 0.76 mm average roughness was selected as being most representative of frost encountered in service. Wind tunnel tests as well as flight tests were carried out. The results show that wing contamination can seriously reduce climb performance and lift. ESA

N88-15776# Boeing Commercial Airplane Co., Seattle, Wash.
EFFECTS OF AIRCRAFT DEICING/ANTIICING FLUIDS ON AIRFOIL CHARACTERISTICS
Eugene G. Hill *In* Von Karman Inst. For Fluid Dynamics, Influence of Environmental Factors on Aircraft Wing Performance Feb. 1987 18 p (For primary document see N88-15771 08-03)
Avail: NTIS HC A11/MF A01

Wind tunnel tests evaluated flow behavior and aerodynamic effects of aircraft deicing and antiicing fluids, primarily ethylene glycol or glycol mixtures. The measurements and observations made during the tests show that all the fluids tested produce a rough, reticulated leading edge surface. Wave fronts of the fluid form near the leading edge and move slowly toward the trailing edge as the airspeed increases. The results justify a cautious approach to the use of these fluids. ESA

N88-15777# Boeing Commercial Airplane Co., Seattle, Wash.
LOW ALTITUDE WINDSHEAR THREAT TO COMMERCIAL AIRCRAFT
George S. Hendrickson and Eugene G. Hill *In* Von Karman Inst. for Fluid Dynamics, Influence of Environmental Factors on Aircraft Wing Performance Feb. 1987 48 p (For primary document see N88-15771 08-03)
Avail: NTIS HC A11/MF A01

The efforts being made in the United States to combat the low altitude windshear threat are reviewed and the influence of windshear on airplane performance is described. Considerable attention is directed toward convective storm phenomena and to the associated flight hazards. Airports are scheduled to be better equipped with Doppler radar to enhance existing systems, providing more timely and reliable warnings of the presence of windshear. ESA

N88-15778*# Douglas Aircraft Co., Inc., Long Beach, Calif. Aircraft Configuration and Performance Dept.
EFFECTS OF ENVIROMENTALLY IMPOSED ROUGHNESS ON AIRFOIL PERFORMANCE
Tuncer Cebeci *In* Von Karman Inst. for Fluid Dynamics, Influence of Environmental Factors on Aircraft Wing Performance Feb. 1987 43 p (For primary document see N88-15771 08-03)
(Grants NAG3-601; NSF MEA-0818565)
Avail: NTIS HC A11/MF A01 CSCL 01C

The experimental evidence for the effects of rain, insects, and ice on airfoil performance are examined. The extent to which the available information can be incorporated in a calculation method in terms of change of shape and surface roughness is discussed. The methods described are based on the interactive boundary layer procedure of Cebeci or on the thin layer Navier Stokes procedure developed at NASA. Cases presented show that extensive flow separation occurs on the rough surfaces. ESA

N88-15779# Lufthansa German Airlines, Cologne (West Germany).
DIGEST OF THE ANNUAL REPORT OF THE LUFTHANSA GERMAN AIRLINES Annual Report, 1986
1987 28 p
(ISSN-0415-603-X; ETN-88-91473) Avail: NTIS HC A03/MF A01

The annual report on the operations and profitability of Lufthansa German Airlines is presented. ESA

N88-15780# National Transportation Safety Board, Washington, D. C. Bureau of Field Operations.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT, US CIVIL AND FOREIGN AVIATION, ISSUE NUMBER 5 OF 1986 ACCIDENTS
2 Nov. 1987 410 p
(PB87-916907; NTSB/AAB-87/07) Avail: NTIS HC A18/MF A01; also avail. paper copy, North American Continent $185.00; all others write for quote CSCL 01C

The publication contains selected aircraft accident reports in Brief Format occurring in U.S. civil and foreign aviation operations during Calendar Year 1986. Approximately 200 General Aviation and Air Carrier accidents contained in the publication represent a random selection. The publication is issued irregularly, normally eighteen times each year. The Brief Format presents the facts, conditions, circumstances, and probable cause(s) for each accident. GRA

N88-15781# National Transportation Safety Board, Washington, D. C. Bureau of Field Operations.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT, US CIVIL AND FOREIGN AVIATION, ISSUE NUMBER 7 OF 1986 ACCIDENTS
4 Nov. 1987 400 p

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The publication contains selected aircraft accident reports in Brief Format occurring in U.S. civil and foreign aviation operations during Calendar Year 1986. Approximately 200 General Aviation and Air Carrier accidents contained in the publication represent a random selection. The publication is issued irregularly, normally eighteen times each year. The Brief Format represents the facts, conditions, circumstances and probable cause(s) for each accident. GRA

N88-15782# National Transportation Safety Board, Washington, D. C. Bureau of Field Operations.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT, US CIVIL AND FOREIGN AVIATION, ISSUE NUMBER 8 OF 1986 ACCIDENTS
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The publication contains selected aircraft accident reports in Brief Format occurring in U.S. civil and foreign aviation operations during calendar year 1986. Approximately 200 General Aviation and Air Carrier accidents contained in the publication represent a random selection. The publication is issued irregularly, normally eighteen times each year. The Brief Format presents the facts, conditions, circumstances, and probable cause(s) for each accident. GRA

N88-15803*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE NASA AIRCRAFT ICING RESEARCH PROGRAM
Robert J. Shaw and John J. Reinmann *In its* Aeropropulsion '87. Session 5: Subsonic Propulsion Technology Nov. 1987 27 p (For primary document see N88-15800 08-07)
Avail: NTIS HC A08/MF A01 CSCL 01C

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Space Communications, Spacecraft Communications, Command and Tracking* and *Communications and Radar.*

N88-15783# Computer Resource Management, Inc., Vienna, Va.
CHICAGO'S O'HARE RUNWAY CONFIGURATION MANAGEMENT SYSTEM (RCMS). VOLUME 2: USERS GUIDE
Anthony Bradley, Helen Monk, and Edward Jaggard Jul. 1987 113 p
(Contract DTFA03-85-C-00046)
(AD-A186222; DOT/FAA/CT-86/15-2) Avail: NTIS HC A06/MF A01 CSCL 01E

Volume I of this report describes the proposed Runway Configuration Management System (RCMS) operational software for review by the facility personnel. It also serves as an input to RCMS functional specifications for the Traffic Management System (TMS) program. Using interactive computer logic, RCMS helps supervisors select runway configurations which reduce aircraft delays by optimizing throughput capacity in dynamic operational environments. Volume II of this report is the User's Guide to the RCMS. Author (GRA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.* For land transportation vehicles see *85 Urban Technology and Transportation.*

N88-15784# Naval Postgraduate School, Monterey, Calif.
A DYNAMIC SIMULATION AND FEEDBACK CONTROL SCHEME FOR THE U.S. MARINE CORPS' AIRBORNE REMOTELY OPERATED DEVICE (AROD) M.S. Thesis
William G. Bassett Sep. 1987 166 p
(AD-A186597) Avail: NTIS HC A08/MF A01 CSCL 01C

The equations of motion for a ducted fan hovering device are developed and programmed in a computer simulation. Experimental aerodynamic data is integrated with the computer model. A feedback control scheme for the multiple-input, multiple-output system is determined using optimal control techniques. Time response results are obtained and analyzed. As a separate issue, the body of the device is modelled for electro-magnetic analysis and a basic radio antenna design is determined for UHF transmission. GRA

N88-15811*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH-SPEED INLET RESEARCH PROGRAM AND SUPPORTING ANALYSES
Robert E. Coltrin *In its* Aeropropulsion '87. Session 6: High-Speed Propulsion Technology Nov. 1987 20 p (For primary document see N88-15807 08-07)
Avail: NTIS HC A06/MF A01 CSCL 01C

N88-16051# Sandia National Labs., Albuquerque, N. Mex.
ANALYSIS OF SHOCK AND VIBRATION ENVIRONMENTS FOR CARGO ON C9B TRANSPORT AIRCRAFT
Thomas J. Baca, James W. Doggett, and Clarence A. Davidson *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 133-146 (For primary document see N88-16040 08-39)
(Contract DE-AC04-76DP-00789)
Avail: NTIS HC A10/MF A01 CSCL 01C

N88-16052# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
COMPREHENSIVE INFLIGHT VIBRATION AND ACOUSTIC TESTING
Phyllis G. Bolds *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 147-154 (For primary document see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxilliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N88-15785*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROPROPULSION '87. SESSION 2: AEROPROPULSION STRUCTURES RESEARCH
Nov. 1987 52 p Conference held in Cleveland, Ohio, 17-19 Nov. 1987 Submitted for publication
(NASA-CP-10003-Sess-2; E-3798-Sess-2; NAS 1.55:10003-Sess-2) Avail: NTIS HC A04/MF A01 CSCL 21E

Aeropropulsion systems present unique problems to the structural engineer. The extremes in operating temperatures, rotational effects, and behaviors of advanced material systems combine into complexities that require advances in many scientific disciplines involved in structural analysis and design procedures. This session provides an overview of the complexities of aeropropulsion structures and the theoretical, computational, and experimental research conducted to achieve the needed advances. For individual titles, see N88-15786 through N88-15789.

N88-15786*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROPROPULSION STRUCTURES
Lester D. Nichols *In its* Aeropropulsion '87. Session 2: Aeropropulsion Structures Research Nov. 1987 10 p (For primary document see N88-15785 08-07)
Avail: NTIS HC A04/MF A01 CSCL 21E

The structural engineer is faced with unique problems when dealing with aeropropulsion systems. He is faced with extremes in operating temperatures, rotational effects, and behaviors of advanced material systems which combine into complexities that require advances in many scientific disciplines involved in structural analysis and design procedures. This presentation provides an overview of the complexities of aeropropulsion structures and the theoretical, computational, and experimental research conducted to achieve the needed advances. Author

N88-15787*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DETERMINING STRUCTURAL PERFORMANCE
Michael A. Ernst and Louis J. Kiraly *In its* Aeropropulsion '87. Session 2: Aeropropulsion Structures Research Nov. 1987 14 p (For primary document see N88-15785 08-07)
Avail: NTIS HC A04/MF A01 CSCL 21E

An overview is given of the methods and concepts developed to enhance and predict structural dynamic characteristics of advanced aeropropulsion systems. Aeroelasticity, Vibration Control, Dynamic Systems, and Computational Structural Methods are four disciplines that make up the research program at NASA/Lewis Research Center. The Aeroelasticity program develops analytical and experimental methods to minimize flutter and forced vibration of aerospace propulsion systems. Both frequency domain and time domain methods have been developed for applications on the turbofan, turbopump, and advanced turboprop. To improve life and performance, the Vibration Control program conceives, analyzes, develops, and demonstrates new methods to control vibrations in aerospace systems. Active and passive vibration control is accomplished with electromagnetic dampers, magnetic bearings, and piezoelectric crystals to control rotor vibrations. The Dynamic Systems program analyzes and verifies the dynamics of interacting systems, as well as develops concepts and methods for high-temperature dynamic seals. The Computational Structural Methods program uses computer science to improve solutions of structural problems. Author

N88-15788*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIFE PREDICTION TECHNOLOGIES FOR AERONAUTICAL PROPULSION SYSTEMS
Michael A. McGaw *In its* Aeropropulsion '87. Session 2: Aeropropulsion Structures Research Nov. 1987 12 p (For primary document see N88-15785 08-07)
Avail: NTIS HC A04/MF A01 CSCL 21E

Fatigue and fracture problems continue to occur in aeronautical gas turbine engines. Components whose useful life is limited by these failure modes include turbine hot-section blades, vanes and disks. Safety considerations dictate that catastrophic failures be avoided, while economic considerations dictate that noncatastrophic failures occur as infrequently as possible. The design decision is therefore in making the tradeoff between engine performance and durability. The NASA Lewis Research Center has contributed to the aeropropulsion industry in the areas of life prediction technology for 30 years, developing creep and fatigue life prediction methodologies for hot-section materials. Emphasis is placed on the development of methods capable of handling both thermal and mechanical fatigue under severe environments. Recent accomplishments include the development of more accurate creep-fatigue life prediction methods such as the total strain version of Lewis' Strainrange Partitioning (SRP) and the HOST-developed Cyclic Damage Accumulation (CDA) model. Other examples include the Double Damage Curve Approach (DDCA), which provides greatly improved accuracy for cumulative fatigue design rules. Author

N88-15789*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTEGRATED ANALYSIS AND APPLICATIONS
Dale A. Hopkins *In its* Aeropropulsion '87. Session 2: Aeropropulsion Structures Research Nov. 1987 12 p (For primary document see N88-15785 08-07)
Avail: NTIS HC A04/MF A01 CSCL 21E

A select overview is provided of ongoing research focusing on the development and verification of integrated structural analysis and optimal design capabilities for advanced aerospace propulsion and power systems. Subjects discussed include the following: (1) Composites - analytical models (composite mechanics), integrated computational methods, and characterization of composite structural response and durability for resin-, metal-, and ceramic-matrix systems; (2) Advanced inelastic analysis - algorithm/numerical methods for more accurate and efficient analysis; (3) Constitutive modeling - theoretical formulation and characterization of thermoviscoplastic material behavior; (4) Computational simulation - engine structures from components to assembly, and up to an entire engine system subjected to simulated test-stand and mission load histories; (5) Probabilistic structural analysis - quantification of the effects of uncertainty in geometry, material, loads, and boundary conditions on structural response for true reliability assessment; and (6) Interdisciplinary optimization - incorporation of mathematical optimization and multidisciplinary analyses to provide streamlined, autonomous optimal design systems. Author

N88-15790*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROPROPULSION '87. SESSION 3: INTERNAL FLUID MECHANICS RESEARCH
Nov. 1987 75 p Conference held in Cleveland, Ohio, 17-19 Nov. 1987 Submitted for publication
(NASA-CP-10003-Sess-3; E-3798-Sess-3; NAS 1.55:10003-Sess-3) Avail: NTIS HC A04/MF A01 CSCL 21E

Internal fluid mechanics research at Lewis is directed toward an improved understanding of the important flow physics affecting aerospace propulsion systems, and applying this improved understanding to formulate accurate predictive codes. To this end, research is conducted involving detailed experimentation and analysis. The presentations in this session summarize ongoing work and indicated future emphasis in three major research thrusts: namely, inlets, ducts, and nozzles; turbomachinery; and chemical

reacting flows. For individual titles, see N88-15791 through N88-15793.

N88-15791*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INLETS, DUCTS AND NOZZLES **c34**
John M. Abbott, Bernhard H. Anderson, and Edward J. Rice *In its* Aeropropulsion '87. Session 3: Internal Fluid Mechanics Research Nov. 1987 24 p (For primary document see N88-15790 08-07)
Avail: NTIS HC A04/MF A01 CSCL 20D

The internal fluid mechanics research program in inlets, ducts, and nozzles is described. The program consists of a balanced effort between the development of computational tools and the conduct of experimental research. The experiments are designed to better understand the fluid flow physics, to develop new or improved flow models, and to provide benchmark quality data sets for validation of the computational methods. The inlet, duct, and nozzle research program is described according to three major classifications of flow phenomena: highly three-dimensional flow fields; shock-boundary layer interactions; and shear layer control. Specific examples of current and future elements of the research program are described for each of these phenomena. In particular, the highly three-dimensional flow field phenomena is highlighted by describing the computational and experiemental research program in transition ducts having a round-to-rectangular area variation. In the case of shock-boundary layer interactions, the specific details of research for normal shock-boundary layer interactions are described. For shear layer control research in vortex generators and the use of aerodynamic excitation for enhancement of the jet mixing process are described. Future research in inlets, ducts, and nozzles will include more emphasis on three-dimensional full Navier-Stokes methods and corresponding experiments designed to concentrate on the appropriate three-dimensional fluid flow physics. Author

N88-15792*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TURBOMACHINERY
Robert J. Simoneau, Anthony J. Strazisar, Peter M. Sockol, Lonnie Reid, and John J. Adamczyk *In its* Aeropropulsion '87. Session 3: Internal Fluid Mechanics Research Nov. 1987 23 p (For primary document see N88-15790 08-07)
Avail: NTIS HC A04/MF A01 CSCL 21E

The discipline research in turbomachinery, which is directed toward building the tools needed to understand such a complex flow phenomenon, is based on the fact that flow in turbomachinery is fundamentally unsteady or time dependent. Success in building a reliable inventory of analytic and experimental tools will depend on how the time and time-averages are treated, as well as on who the space and space-averages are treated. The raw tools at disposal (both experimentally and computational) are truly powerful and their numbers are growing at a staggering pace. As a result of this power, a case can be made that a situation exists where information is outstripping understanding. The challenge is to develop a set of computational and experimental tools which genuinely increase understanding of the fluid flow and heat transfer in a turbomachine. Viewgraphs outline a philosophy based on working on a stairstep hierarchy of mathematical and experimental complexity to build a system of tools, which enable one to aggressively design the turbomachinery of the next century. Examples of the types of computational and experimental tools under current development at Lewis, with progress to date, are examined. The examples include work in both the time-resolved and time-averaged domains. Finally, an attempt is made to identify the proper place for Lewis in this continuum of research. Author

N88-15793*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHEMICAL REACTING FLOWS **c25**
Edward J. Mularz and Peter M. Sockol *In its* Aeropropulsion '87. Session 3: Internal Fluid Mechanics Research Nov. 1987 20 p (For primary document see N88-15790 08-07)
Avail: NTIS HC A04/MF A01 CSCL 21B

Future aerospace propulsion concepts involve the combination of liquid or gaseous fuels in a highly turbulent internal air stream. Accurate predictive computer codes which can simulate the fluid mechanics, chemistry, and turbulence combustion interaction of these chemical reacting flows will be a new tool that is needed in the design of these future propulsion concepts. Experimental and code development research is being performed at Lewis to better understand chemical reacting flows with the long term goal of establishing these reliable computer codes. The approach to understanding chemical reacting flows is to look at separate simple parts of this complex phenomena as well as to study the full turbulent reacting flow process. As a result research on the fluid mechanics associated with chemical reacting flows was initiated. The chemistry of fuel-air combustion is also being studied. Finally, the phenomena of turbulence-combustion interaction is being investigated. This presentation will highlight research, both experimental and analytical, in each of these three major areas. Author

N88-15794*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROPROPULSION '87. SESSION 4: INSTRUMENTATION AND CONTROLS RESEARCH
Nov. 1987 77 p Conference held in Cleveland, Ohio, 17-19 Nov. 1987 Submitted for publication
(NASA-CP-10003-Sess-4; E-3798-Sess-4; NAS 1.55:10003-Sess-4) Avail: NTIS HC A05/MF A01 CSCL 21E

The Lewis Research Center has had a long history of research directed toward advancing the national capability in the areas of propulsion research instrumentation and propulsion controls. Some of the major advances from this research that are currently in use are highlighted as well as some of the ongoing and planned research that will strongly impact the future capabilities. The presentations will cover the efforts on research instrumentation and controls as well as the research on high temperature electronics. This introductory section will focus on the major drivers or needs of the aeropropulsion industry that have shaped the instrumentation and controls research programs. Also covered will be the technological opportunities that have greatly impacted the program and that permitted break-throughs in several areas. For individual titles, see N88-15795 through N88-15799.

N88-15795*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RESEARCH SENSORS **c35**
David R. Englund *In its* Aeropropulsion '87. Session 4: Instrumentation and Controls Research Nov. 1987 12 p (For primary document see N88-15794 08-07)
Avail: NTIS HC A05/MF A01 CSCL 14B

The program described covers development of sensors and sensing techniques for research applications on aeropropulsion systems. In general, the sensors are used in-situ to measure the environment at a given location within a turbine engine, or to measure the response of an engine component to the imposed environment. Locations of concern are generally in the gas path and, for the most part, are within the hot section. Specific parameters of concern are dynamic gas temperature, heat flux, airfoil surface temperature, and strain on airfoils and combustor liners. In order to minimize the intrusiveness of surface-mounted sensors, a considerable effort was expended to develop thin-film sensors for surface temperature, strain, and heat flux measurements. Most of the work described is sufficiently advanced that sensors were used and useful data were obtained. The notable exception is the work to develop a high-temperature static strain measuring capability; this work is still in progress. Author

N88-15796*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTICAL MEASUREMENT SYSTEMS **c74**
Daniel J. Lesco *In its* Aeropropulsion '87. Session 4: Instrumentation and Controls Research Nov. 1987 17 p

(For primary document see N88-15794 08-07)
Avail: NTIS HC A05/MF A01 CSCL 09C

Some of the areas of research conducted at Lewis on optical measurement techniques are described. Two laser anemometer systems developed at Lewis are used to illustrate the special instrumentation needs encountered in aeropropulsion research. Velocity measurements to be made through small viewing ports, close to surfaces within the propulsion system components, and in turbulent or highly-accelerating flows are some of the significant challenges. The application to research facilities of two advanced optical systems, the rainbow schlieren and the combustor viewing system, is presented. The calibration and verification of commercial optical measuring systems, such as droplet sizing systems, are also discussed. Calibration techniques capable of simulating moving droplets for flight-type sizing systems are being developed at Lewis. The presentation concludes with a brief look at the forces driving future research on optical instrumentation. Author

N88-15797*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH-TEMPERATURE ELECTRONICS **c33**
Gary T. Seng *In its* Aeropropulsion '87. Session 4: Instrumentation and Controls Research Nov. 1987 10 p (For primary document see N88-15794 08-07)
Avail: NTIS HC A05/MF A01 CSCL 20F

In recent years, there was a growing need for electronics capable of sustained high-temperature operation for aerospace propulsion system instrumentation, control and condition monitoring, and integrated sensors. The desired operating temperature in some applications exceeds 600 C, which is well beyond the capability of currently available semiconductor devices. Silicon carbide displays a number of properties which make it very attractive as a semiconductor material, one of which is the ability to retain its electronic integrity at temperatures well above 600 C. An IR-100 award was presented to NASA Lewis in 1983 for developing a chemical vapor deposition process to grow single crystals of this material on standard silicon wafers. Silicon carbide devices were demonstrated above 400 C, but much work remains in the areas of crystal growth, characterization, and device fabrication before the full potential of silicon carbide can be realized. The presentation will conclude with current and future high-temperature electronics program plans. Although the development of silicon carbide falls into the category of high-risk research, the future looks promising, and the potential payoffs are tremendous. Author

N88-15798*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FIBER OPTICS FOR CONTROLS **c74**
Gary T. Seng *In its* Aeropropulsion '87. Session 4: Instrumentation and Controls Research Nov. 1987 14 p (For primary document see N88-15794 08-07)
Avail: NTIS HC A05/MF A01 CSCL 20F

The challenge of those involved in control-system hardware development is to accommodate an ever-increasing complexity in aircraft control, while limiting the size and weight of the components and improving system reliability. A technology that displays promise towards this end is the area of fiber optics for controls. The primary advantages of employing optical fibers, passive optical sensors, and optically controlled actuators are weight and volume reduction, immunity from electromagnetic effects, superior bandwidth capabilities, and freedom from short circuits and sparking contacts. Since 1975, NASA Lewis has performed in-house, contract, and grant research in fiber optic sensors, high-temperature electro-optic switches, and fly-by-light control-system architecture. Passive optical sensor development is an essential yet challenging area of work and has therefore received much attention during this period. A major effort to develop fly-by-light control-system technology, known as the Fiber-Optic Control System Integration (FOCSI) program, was initiated in 1985 as a cooperative effort between NASA and DOD. Phase 1 of FOCSI, completed in 1986, was aimed at the design of a fiber-optic integrated propulsion/flight control system. Phase 2, yet to be initiated, will provide subcomponent and system development, and a system engine test. In addition to a summary of the benefits of fiber optics, the FOCSI program, sensor advances, and future directions in the NASA Lewis program will be discussed. Author

N88-15799*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIRECTIONS IN PROPULSION CONTROL
Carl F. Lorenzo *In its* Aeropropulsion '87. Session 4: Instrumentation and Controls Research Nov. 1987 15 p (For primary document see N88-15794 08-07)
Avail: NTIS HC A05/MF A01 CSCL 21E

The research needs in the area of propulsion control as driven by trends in advanced aircraft are considered. Ongoing propulsion control research at NASA Lewis is discussed. Special emphasis is made on research to improve control system reliability through the use of analytical redundancy to accommodate failed control sensors. In conclusion, a discussion of new research thrusts in the area of supersonic STOVL integrated control and intelligent system control is presented. Author

N88-15800*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROPROPULSION '87. SESSION 5: SUBSONIC PROPULSION TECHNOLOGY
Nov. 1987 153 p Conference held in Cleveland, Ohio, 17-19 Nov. 1987 Submitted for publication
(NASA-CP-10003-Sess-5; E-3798-Sess-5; NAS 1.55:10003-Sess-5) Avail: NTIS HC A08/MF A01 CSCL 21E

NASA is conducting aeropropulsion research over a broad range of Mach numbers. In addition to the high-speed propulsion research described, major progress was recorded in research aimed at the subsonic flight regimes of interest to many commercial and military users. Recent progress and future directions in such areas as small engine technology, rotorcraft transmissions, icing, Hot Section Technology (HOST) and the Advanced Turboprop Program (ATP) are covered. For individual titles, see N88-15801 through N88-15806.

N88-15801*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SMALL ENGINE TECHNOLOGY PROGRAMS
Richard W. Niedzwiecki *In its* Aeropropulsion '87. Session 5: Subsonic Propulsion Technology Nov. 1987 35 p (For primary document see N88-15800 08-07)
Avail: NTIS HC A08/MF A01 CSCL 21E

Small engine technology programs being conducted at the NASA Lewis Research Center are described. Small gas turbine research is aimed at general aviation, commutercraft, rotorcraft, and cruise missile applications. The Rotary Engine Program is aimed at supplying fuel flexible, fuel efficient technology to the general aviation industry, but also has applications to other missions. There is a strong element of synergism between the various programs in several respects. All of the programs are aimed towards highly efficient engine cycles, very efficient components, and the use of high temperature structural ceramics. This research tends to be generic in nature and has broad applications. The Heavy Duty Diesel Transport (HDTT), rotary technology, and the compound cycle programs are all examining approached to minimum heat rejection, or adiabatic systems employing advanced materials. The Automotive Gas Turbine (AGT) program is also directed towards ceramics application to gas turbine hot section components. Turbomachinery advances in the gas turbines wil benefit advanced turbochargers and turbocompounders for the intermittent combustion systems, and the fundamental understandings and analytical codes developed in the research and technology program will be directly applicable to the system projects. Author

N88-15802*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROTORCRAFT TRANSMISSION **c37**
John J. Coy *In its* Aeropropulsion '87. Session 5: Subsonic

Propulsion Technology Nov. 1987 9 p (For primary document see N88-15800 08-07)
Avail: NTIS HC A08/MF A01 CSCL 13I

The NASA Lewis Research Center and the U.S. Army Aviation Systems Command share an interest in advancing the technology for helicopter propulsion systems. In particular, this presentation outlines that portion of the program that applies to the drive train and its various mechanical components. The major goals of the program are to increase the life, reliability, and maintainability; reduce the weight, noise, and vibration; and maintain the relatively high mechanical efficiency of the gear train. The current activity emphasizes noise reduction technology and analytical code development followed by experimental verification. Selected significant advances in technology for transmissions are reviewed, including advanced configurations and new analytical tools. Finally, the plan for transmission research in the future is presented.
Author

N88-15803*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE NASA AIRCRAFT ICING RESEARCH PROGRAM c03
Robert J. Shaw and John J. Reinmann *In its* Aeropropulsion '87. Session 5: Subsonic Propulsion Technology Nov. 1987 27 p (For primary document see N88-15800 08-07)
Avail: NTIS HC A08/MF A01 CSCL 01C

The objective of the NASA aircraft icing research program is to develop and make available to industry icing technology to support the needs and requirements for all weather aircraft designs. Research is being done for both fixed and rotary wing applications. The NASA program emphasizes technology development in two key areas: advanced ice protection concepts and icing simulation (analytical and experimental). The computer code development/validation, icing wind tunnel testing, and icing flight testing efforts which were conducted to support the icing technology development are reviewed.
Author

N88-15804*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AIRCRAFT ENGINE HOT SECTION TECHNOLOGY: AN OVERVIEW OF THE HOST PROJECT
Daniel E. Sokolowski and Marvin H. Hirschberg *In its* Aeropropulsion '87. Session 5: Subsonic Propulsion Technology Nov. 1987 10 p (For primary document see N88-15800 08-07)
Avail: NTIS HC A08/MF A01 CSCL 21E

NASA sponsored the Turbine Engine Hot Section Technology (HOST) Project to address the need for improved durability in advanced aircraft engine combustors and turbines. Analytical and experimental activities aimed at more accurate prediction of the aerothermal environment, the thermomechanical loads, the material behavior and structural responses to loads, and life predictions for cyclic high-temperature operation were underway for the last 7 years. The project has involved representatives from six engineering disciplines who are spread across three work sectors (industry, academia, and NASA). The HOST Project not only initiated and sponsored 70 major activities, but was also the keystone in joining the multiple disciplines and work sectors to focus on critical research needs. A broad overview of the project is given along with initial indications of the project's impact.
Author

N88-15805*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OVERVIEW OF NASA PTA PROPFAN FLIGHT TEST PROGRAM
Edwin J. Graber *In its* Aeropropulsion '87. Session 5: Subsonic Propulsion Technology Nov. 1987 26 p (For primary document see N88-15800 08-07)
Avail: NTIS HC A08/MF A01 CSCL 21E

During the last several years high-speed propellers have made the transition from a wind tunnel curiosity to a very likely near-term, fuel-efficient propulsion system that could revolutionize the subsonic commercial air transport industry. A key ingredient in this remarkable progress is the advanced turboprop industry. Working together, NASA and industry have developed and flight tested two propeller propulsion systems to provide answers to key technical questions and concerns. An industry team is currently developing a third propeller propulsion system for flight testing late this year. The progress of one of the NASA-industry flight test programs, called the Propfan Test Assessment (PTA) Program is reported. In PTA, a 9 foot diameter propfan was installed on the left wing of a Gulfstream GII executive jet and is undergoing extensive flight testing at Dobbins Air Force Base to evaluate propfan structural integrity, near and far field noise, and cabin interior noise characteristics. This research testing includes variations in propeller tip speed and power loading, nacelle tilt angle, and aircraft Mach number and altitude. As a result, extensive parametric data will be obtained to verify and improve computer codes for predicting propeller structural aeroelastic, aerodynamic, and acoustic characteristics. Over 600 measurements are being recorded for each of approximately 600 flight test conditions.
Author

N88-15806*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED PROPELLER RESEARCH
John F. Groeneweg and Lawrence J. Bober *In its* Aeropropulsion '87. Session 5: Subsonic Propulsion Technology Nov. 1987 30 p (For primary document see N88-15800 08-07)
Avail: NTIS HC A08/MF A01 CSCL 21E

Resent results of aerodynamic and acoustic research on both single and counter-rotation propellers are reviewed. Data and analytical results are presented for three propellers: SR-7A, the single rotation design used in the NASA Propfan Test Assessment (PTA); and F7-A7, the 8+8 counterrotating design used in the proof-of-concept Unducted Fan (UDF) engine. In addition to propeller efficiencies, cruise and takeoff noise, and blade pressure data, off-design phenomena involving formation of leading edge vortices are described. Aerodynamic and acoustic computational results derived from three-dimensional Euler and acoustic radiation codes are presented. Research on unsteady flows, which are particularly important for understanding counterrotation interaction noise, unsteady loading effects on acoustics, and flutter or forced response is described. The first results of three-dimensional unsteady Euler solutions are illustrated for a single rotation propeller at an angle of attack and for a counterrotation propeller. Basic experimental and theoretical results from studies of the unsteady aerodynamics of oscillating cascades are outlined. Finally, advanced concepts involving swirl recovery vanes and ultra bypass ducted propellers are discussed.
Author

N88-15807*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROPROPULSION '87. SESSION 6: HIGH-SPEED PROPULSION TECHNOLOGY
Nov. 1987 119 p Conference held in Cleveland, Ohio, 17-19 Nov. 1987 Submitted for publication
(NASA-CP-10003-Sess-6; E-3798-Sess-6; NAS 1.55:10003-Sess-6) Avail: NTIS HC A06/MF A01 CSCL 21E

NASA is conducting aeronautical research over a broad range of Mach numbers. In addition to the advanced CTOL propulsion research described in a separate session, the Lewis Research Center has intensified its efforts towards propulsion technology for selected high-speed flight applications. In a companion program, the Langley Research Center has also accomplished excellent research in Supersonic Combustion Ramjet (SCRAM) propulsion. What is presented in this session is an unclassified review of some of the propulsion research results that are applicable for supersonic to hypersonic vehicles. Not only is a review provided for several key work areas, it also presents a viewpoint on future research directions by calling attention to cycles, components, and facilities involved in this rapidly expanding field of work. For individual titles, see N88-15808 through N88-15812.

N88-15808*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUPERSONIC STOVL PROPULSION TECHNOLOGY PROGRAM: AN OVERVIEW

Bernard J. Blaha and Peter G. Batterton *In its* Aeropropulsion '87. Session 6: High-Speed Propulsion Technology Nov. 1987 23 p (For primary document see N88-15807 08-07)
Avail: NTIS HC A06/MF A01 CSCL 21E

Planning activities are continuing between NASA, DOD, and two foreign governments to develop the technology and to demonstrate the design capability for advanced, supersonic, short-takeoff and vertical-landing (STOVL) aircraft by the mid-1990s. As a result, a Memorandum of Understanding (MOU) was established by the United Kingdom to jointly pursue the required technology; and an MOU with Canada is expected to be signed shortly. The NASA Lewis Research Center will play a lead role in the development of the required propulsion technologies which were identified as being critical to achieve viable STOVL aircraft. These planning activities have already resulted in initial research programs focused on technologies common to two or more of the proposed propulsion system concepts. An overview of the Lewis Research Center's role in the overall program plan and recent results in the development of the required propulsion technologies is presented. Author

N88-15809*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROPULSION CHALLENGES AND OPPORTUNITIES FOR HIGH-SPEED TRANSPORT AIRCRAFT
William C. Strack *In its* Aeropropulsion '87. Session 6: High-Speed Propulsion Technology Nov. 1987 19 p (For primary document see N88-15807 08-07)
Avail: NTIS HC A06/MF A01 CSCL 21E

For several years there was a growing interest in the subject of efficient sustained supersonic cruise technology applied to a high-speed transport aircraft. The major challenges confronting the propulsion community for supersonic transport (SST) applications are identified. Both past progress and future opportunities are discussed in relation to perceived technology shortfalls for an economically successful SST that satisfies environmental constraints. A very large improvement in propulsion system efficiency is needed both at supersonic and subsonic cruise conditions. Toward that end, several advanced engine concepts are being considered that, together with advanced discipline and component technologies, promise at least 40 percent better efficiency that the Concorde engine. The quest for higher productivity through higher speed is also thwarted by the lack of a conventional, low-priced fuel that is thermally stable at the higher temperatures associated with faster flight. Airport noise remains a tough challenge because previously researched concepts fall short of achieving FAR 36 Stage 3 noise levels. Innovative solutions may be necessary to reach acceptably low noise. While the technical challenges are indeed formidable, it is reasonable to assume that the current shortfalls in fuel economy and noise can be overcome through an aggressive propulsion research program. Author

N88-15810*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUPERSONIC THROUGHFLOW FANS FOR HIGH-SPEED AIRCRAFT
Calvin L. Ball *In its* Aeropropulsion '87. Session 6: High-Speed Propulsion Technology Nov. 1987 26 p (For primary document see N88-15807 08-07)
Avail: NTIS HC A06/MF A01 CSCL 21E

Increased need for more efficient long-range supersonic flight has revived interest in the supersonic throughflow fan as a possible component for advanced high-speed propulsion systems. A fan that can operate with supersonic inlet axial Mach numbers would reduce the inlet losses incurred in diffusing the flow from supersonic Mach numbers to a subsonic one at the fan face. In addition, the size and weight of an all-supersonic inlet will be substantially lower than those of a conventional inlet. However, the data base for components of this type is practically nonexistent. Therefore, in order to furnish the required information for assessing the potential for this type of fan, the NASA Lewis Research Center has begun a program to design, analyze, build, and test a fan stage that is capable of operating with supersonic axial velocities from inlet to exit. The objectives are to demonstrate the feasibility and potential of supersonic throughflow fans, to gain a fundamental understanding of the flow physics associated with such systems, and to develop an experimental data base for design and analysis code validation. A brief overview of past supersonic throughflow fan activities are provided; the technology needs discussed; the design of a supersonic throughflow fan stage, a facility inlet, and a downstream diffuser described; and the results from the analysis codes used in executing the design are presented. Also presented is an engine concept intended to permit establishing supersonic throughflow within the fan on the runway and maintaining the supersonic throughflow condition within the fan throughout the flight envelope. Author

N88-15811*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH-SPEED INLET RESEARCH PROGRAM AND SUPPORTING ANALYSES **c05**
Robert E. Coltrin *In its* Aeropropulsion '87. Session 6: High-Speed Propulsion Technology Nov. 1987 20 p (For primary document see N88-15807 08-07)
Avail: NTIS HC A06/MF A01 CSCL 01C

A Mach 5 cruise aircraft was studied in a joint program effort. The propulsion system chosen for this aircraft was an over-under turbojet/ramjet system. The ramjet portion of the inlet is to be tested in NASA Lewis' 10 x 10 SWT. Goals of the test program are to obtain performance data and bleed requirements, and also to obtain analysis code validation data. Supporting analysis of the inlet using a three-dimensional Navier-Stokes code (PEPSIS) indicates that sidewall shock/boundary layer interactions cause large separated regions in the corners underneath the cowl. Such separations generally lead to inlet unstart, and are thus a major concern. As a result of the analysis, additional bleed regions were added to the inlet model sidewalls and cowl to control separations in the corners. A two-dimensional analysis incorporating bleed on the ramp is also presented. Supporting experiments for the Mach 5 programs were conducted in the Lewis' 1 x 1 SWT. A small-scale model representing the inlet geometry up to the ramp shoulder and cowl lip was tested to verify the accelerator plate test technique and to obtain data on flow migration in the ramp and sidewall boundary layers. Another study explored several ramp bleed configurations to control boundary layer separations in that region. Design of a two-dimensional Mach 5 cruise inlet represents several major challenges including multimode operation and dual flow, high temperatures, and three-dimensional airflow effects. Author

N88-15812*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HYPERSONIC PROPULSION RESEARCH
G. Burton Northam *In* NASA. Lewis Research Center, Aeropropulsion '87. Session 6: High-Speed Propulsion Technology Nov. 1987 20 p (For primary document see N88-15807 08-07)
Avail: NTIS HC A06/MF A01 CSCL 21E

The NASA Langley Research Center has conducted hypersonic propulsion research since the 1960s. A variety of inlet concepts were explored and characterized. The emphasis of the inlet program was the development of the short (light weight), fixed geometry, side-wall-compression inlets that operate efficiently over a wide Mach number range. As hypersonic combustion tunnels were developed, programs to study the parameters controlling fuel mixing and combustion with single and multiple strut models were conducted using direct connect test techniques. These various tests supported the design of subscale engine test hardware that integrated inlet and combustor technology and allowed the study of the effect of heat release on thrust and combustor/inlet interaction. A number of subscale engine tests have demonstrated predicted performance levels at Mach 4 and 7 simulated flight conditions. Author

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

For related information see also *05 Aircraft Design, Testing and Performance.*

N88-15813*# Purdue Univ., West Lafayette, Ind.
A SIMULATION STUDY OF THE FLIGHT DYNAMICS OF ELASTIC AIRCRAFT. VOLUME 2: DATA
Martin R. Waszak, John B. Davidson, and David K. Schmidt Washington NASA Dec. 1987 223 p
(Grant NAG1-254)
(NASA-CR-4102-Vol-2; NAS 1.26:4102-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 01C

The simulation experiment described addresses the effects of structural flexibility on the dynamic characteristics of a generic family of aircraft. The simulation was performed using the NASA Langley VMS simulation facility. The vehicle models were obtained as part of this research project. The simulation results include complete response data and subjective pilot ratings and comments and so allow a variety of analyses. The subjective ratings and analysis of the time histories indicate that increased flexibility can lead to increased tracking errors, degraded handling qualities, and changes in the frequency content of the pilot inputs. These results, furthermore, are significantly affected by the visual cues available to the pilot. Author

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N88-15814*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL INVESTIGATION OF THE SUBSONIC HIGH-ALTITUDE OPERATION OF THE NASA LEWIS 10- BY 10-FOOT SUPERSONIC WIND TUNNEL
Christopher E. Hughes and Robert J. Jeracki Jan. 1988 26 p
(NASA-TM-100214; E-3823; NAS 1.15:100214) Avail: NTIS HC A03/MF A01 CSCL 14B

An experimental investigation was conducted in the NASA Lewis 10- by 10-Foot Supersonic Wind Tunnel during subsonic tunnel operation in the aerodynamic cycle to determine the test section flow characteristics near the Advanced Turboprop Project propeller model plane of rotation. The investigation used an eight-probe pitot static flow survey rake to measure total and static pressures at two locations in the wind tunnel: the test section and the bellmouth section (upstream of the two-dimensional flexible-wall nozzle). A cone angularity probe was used to measure any flow angularity in the test section. The evaluation was conducted at tunnel Mach numbers from 0.10 to 0.35 and at three operating altitudes from 2,000 to 50,000 ft. which correspond to tunnel reference total pressures from 1960 to 245 psfa, respectively. The results of this experimental investigation indicate a total-pressure loss area in the center of the test section and a static-pressure gradient from the test section centerline to the wall. These total and static pressure differences were observed at all tunnel operating altitudes and diminished at lower tunnel velocities. The total-pressure loss area was also found in the bellmouth section, which indicates that the loss mechanism is not the tunnel flexible-wall nozzle. The flow in the test section is essentially axial since very small flow angles were measured. The results also indicate that a correction to the tunnel total and static pressures must be applied in order to determine accurate freestream conditions at the test section centerline. Author

N88-15815*# George Washington Univ., Washington, D.C.
THEORETICAL AND EXPERIMENTAL STUDIES OF THE TRANSONIC FLOW FIELD AND ASSOCIATED BOUNDARY CONDITIONS NEAR A LONGITUDINALLY-SLOTTED WIND-TUNNEL WALL Ph.D. Thesis
Joel Lee Everhart 14 Feb. 1988 308 p Sponsored by NASA Langley Research Center, Hampton, Va.
(NASA-CR-181169; NAS 1.26:181169) Avail: NTIS HC A14/MF A01 CSCL 14B

A theoretical examination of the slotted-wall flow field is conducted to determine the appropriate wall pressure drop (or boundary condition) equation. This analysis improves the understanding of the fluid physics of these types of flow fields and helps in evaluating the uncertainties and limitations existing in previous mathematical developments. It is shown that the resulting slotted-wall boundary condition contains contributions from the airfoil-induced streamline curvature and the non-linear, quadratic, slot crossflow in addition to an often neglected linear term which results from viscous shearing in the slot. Existing and newly acquired experimental data are examined in the light of this formulation and theoretical developments. Author

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N88-15816*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ADVANCING AUTOMATION AND ROBOTICS TECHNOLOGY FOR THE SPACE STATION AND FOR THE US ECONOMY: SUBMITTED TO THE UNITED STATES CONGRESS OCTOBER 1, 1987 Progress Report No. 5, 16 May - 30 Sep. 1987
Sep. 1987 46 p
(NASA-TM-100777; NAS 1.15:100777) Avail: NTIS HC A03/MF A01 CSCL 22A

In April 1985, as required by Public Law 98-371, the NASA Advanced Technology Advisory Committee (ATAC) reported to Congress the results of its studies on advanced automation and robotics technology for use on the space station. This material was documented in the initial report (NASA Technical Memorandum 87566). A further requirement of the Law was that ATAC follow NASA's progress in this area and report to Congress semiannually. This report is the fifth in a series of progress updates and covers the period between 16 May 1987 and 30 September 1987. NASA has accepted the basic recommendations of ATAC for its space station efforts. ATAC and NASA agree that the mandate of Congress is that an advanced automation and robotics technology be built to support an evolutionary space station program and serve as a highly visible stimulator affecting the long-term U.S. economy. Author

N88-15817*# National Aeronautics and Space Administration, Washington, D.C.
ADVANCING AUTOMATION AND ROBOTICS TECHNOLOGY FOR THE SPACE STATION AND FOR THE US ECONOMY: SUBMITTED TO THE UNITED STATES CONGRESS MAY 15, 1987 Progress Report No. 4, Oct. 1986 - 15 May 1987
May 1987 61 p
(NASA-TM-89811; NAS 1.15:89811) Avail: NTIS HC A04/MF A01 CSCL 22A

In April 1985, as required by Public Law 98-371, the NASA Advanced Technology Advisory Committee (ATAC) reported to Congress the results of its studies on advanced automation and robotics technology for use on the space station. This material was documented in the initial report (NASA Technical Memorandum 87566). A further requirement of the Law was that ATAC follow NASA's progress in this area and report to Congress semiannually. This report is the fourth in a series of progress updates and covers the period October 1, 1986 to May 15, 1987. NASA has accepted the basic recommendations of ATAC for its space station efforts. ATAC and NASA agree that the will of Congress is to

build an advanced automation and robotics technology base that will support an evolutionary space station program and serve as a highly visible stimulator affecting the long-term U.S. economy. The progress report identifies the work of NASA and the space station study contractors, research in progress, and issues connected with the advancement of automation and robotics technology on the space station. Author

N88-15818*# National Aeronautics and Space Administration, Washington, D.C.
ADVANCING AUTOMATION AND ROBOTICS TECHNOLOGY FOR THE SPACE STATION AND FOR THE US ECONOMY: SUBMITTED TO THE UNITED STATES CONGRESS OCTOBER 1, 1986 Progress Report No. 3, Apr. - Sep. 1986
Sep. 1986 58 p
(NASA-TM-89190; NAS 1.15:89190) Avail: NTIS HC A04/MF A01 CSCL 22A

In April 1985, as required by Public Law 98-371, the NASA Advanced Technology Advisory Committee (ATAC) reported to Congress the results of its studies on advanced automation and robotics technology for use on the space station. This material was documented in the initial report (NASA Technical Memorandum 87566). A further requirement of the Law was that ATAC follow NASA's progress in this area and report to Congress semiannually. This report is the third in a series of progress updates and covers the period between April 1, 1986 and September 30, 1986. NASA has accepted the basic recommendations of ATAC for its space station efforts. ATAC and NASA agree that the will of Congress is to build an advanced automation and robotics technology base that will support an evolutionary space station program and serve as a highly visible stimulater affecting the long-term U.S. economy. The progress report identifies the work of NASA and the space station study contractors, research in progress, and issues connected with the advancement of automation and robotics technology on the space station. Author

N88-16118# Joint Publications Research Service, Arlington, Va.
ADVANTAGES OF MANNED LUNAR BASE
V. V. Shevchenko *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 145-156 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 60-68 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbital and launching dynamics.

N88-15819# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
AN EVALUATION OF SEMIANALYTICAL SATELLITE THEORY AGAINST LONG ARCS OF REAL DATA FOR HIGHLY ECCENTRIC ORBITS M.S. Thesis
Martin E. Fieger Jan. 1987 213 p
(AD-A185825; AFIT/CI/NR-87-52T) Avail: NTIS HC A10/MF A01 CSCL 22C

The objective of this thesis was to test the semianalytical satellite theory (SST) as implemented in the Charles Stark Draper Lab. version of the Goddard Trajectory Determination System against long arcs of real data of highly eccentric orbits. The real data consisted of a 9-year arc of NORAD element sets for NSSC 9829, the Soviet Molniya 2-17 spacecraft; an 18-month arc of element sets for NSSC 14095, the ESA Exosat; and an 18-month arc of NORAD observations and element sets for NSSC 13364, the Soviet Molniya 1-57 spacecraft. The uses of elliptical orbits and the need for long-term predictions are reviewed as is the application of artificial satellite theory to elliptical orbits, including a summary of previous applications of satellite theory to highly elliptical orbits. The overall test method involved: (1) Pre-processing NORAD data; (2) Determining an initial state using an SST DC; (3) Generating an SST prediction file; and (4) Evaluating the SST prediction. This study shows that the semianalytical theory results in very satisfactory predictions for orbits of high eccentricity. For Molniya-type orbits, the results obtained when using actual observational data were superior to the results obtained when using element sets. For orbits of even higher eccentricity, the SST results were still very satisfactory. GRA

N88-15820*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A STUDY TO EVALUATE STS HEADS-UP ASCENT TRAJECTORY PERFORMANCE EMPLOYING A MINIMUM-HAMILTONIAN OPTIMIZATION STRATEGY
Sujit Sinha Feb. 1988 56 p
(NASA-TP-2793; M-580; NAS 1.60:2793) Avail: NTIS HC A04/MF A01 CSCL 22A

A study was conducted to evaluate the performance implications of a heads-up ascent flight design for the Space Transportation System, as compared to the current heads-down flight mode. The procedure involved the use of the Minimum Hamiltonian Ascent Shuttle Trajectory Evaluation Program, which is a three-degree-of-freedom moment balance simulation of shuttle ascent. A minimum-Hamiltonian optimization strategy was employed to maximize injection weight as a function of maximum dynamic pressure constraint and Solid Rocket Motor burnrate. Performance Reference Mission Four trajectory groundrules were used for consistency. The major conclusions are that for heads-up ascent and a mission nominal design maximum dynamic pressure value of 680 psf, the optimum solid motor burnrate is 0.394 ips, which produces a performance enhancement of 4293 lbm relative to the baseline heads-down ascent, with 0.368 ips burnrate solid motors and a 680 psf dynamic pressure constraint. However, no performance advantage exists for heads-up flight if the current Solid Rocket Motor target burnrate of 0.368 ips is used. The advantage of heads-up ascent flight employing the current burnrate is that Space Shuttle Main Engine throttling for dynamic pressure control is not necessary. Author

N88-16075# Joint Publications Research Service, Arlington, Va.
LIMITATION OF SPACECRAFT ORBIT NEAR COLINEAR LIBRATION CENTER OF LIMITED ELLIPTICAL THREE BODY PROBLEM Abstract Only
P. Ye. Elyasberg and T. A. Timokhova *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 64 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 293, no. 1, Mar. 1987 p 55-58 Original language document was announced in IAA as A87-35840 (For primary document see N88-16063 08-42)
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N88-16081# Joint Publications Research Service, Arlington, Va.
PERIODIC ORBITS OF LIMITED ELLIPTICAL THREE BODY PROBLEM Abstract Only
V. P. Yevteyev *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 70 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 321-323 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16100# Joint Publications Research Service, Arlington, Va.
SINGLE-BURN TRANSFER TO NOMINALLY PERIODIC ORBIT IN THE VICINITY OF POINT L2 OF EARTH-SUN SYSTEM AND RELATED PROBLEMS Abstract Only
M. L. Lidov, V. A. Lyakhova, and N. M. Teslenko *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 103 Transl. into ENGLISH from Kosmicheskiya Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 163-185 Original language document was announced in IAA as A87-41733 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

N88-16235# Swedish Space Corp., Esrange.
ESRANGE (SWEDEN): NEW INSTALLATIONS, FUTURE PLANS AND INVESTMENTS
A. Helger *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 221-224 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

N88-16236# Andoya Rocket Range, Andenes (Norway).
FACILITIES AND PLANS FOR IMPROVEMENTS AT ANDOYA (NORWAY) ROCKET RANGE
K. Adolfsen and I. Nyheim *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 225-227 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

N88-16237# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
THE DFVLR-GERMAN SPACE OPERATIONS CENTER (GSOC) MOBILE ROCKET BASE
K. Zdarsky, W. Gabriel, X. M. Kalteis, and P. Turner *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 229-234 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

N88-16238# Centre National d'Etudes Spatiales, Toulouse (France).
OPERATIONAL ACTIVITY AND IMPROVEMENTS IN THE SERVICES AND FACILITIES OF THE BALLOON LAUNCH CENTERS IN FRANCE
P. Faucon *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 235-238 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles.

For related information see also *20 Spacecraft Propulsion and Power.*

N88-15821# Selenia Spazio S.p.A., Rome (Italy).
ARIANE LOCALIZATION TECHNIQUE BY DATA RELAY SATELLITE (DRS) Final Report
A. Arcidiacono Paris, France ESA 1987 178 p
(Contract ESA-6171/85-NL-PB (SC))
(SES/ENG/TN-548/86; ESA-CR(P)-2455; ETN-88-91415)
Copyright Avail: NTIS HC A09/MF A01

Localization of Ariane during 1000 sec following launch using 1 DRS in synchronous orbit is discussed. The localization principle proposed is based on an S-band two arms interferometer mounted aboard the DRS. The interferometer baseline length is of the order of 40 lambda, to obtain sufficient sensitivity. Problems of phase ambiguity are solved by on ground processing which through elaboration covers 2 pi transitions. The PN code modulating the Ariane emissions is needed to solve multipath problems, while CW emission from the base is required to discriminate between signal types during self calibration. The adoption of a CW tone from ground is also essential to eliminate S/C body motion induced errors in the localization. The proposed solution is economically attractive compared with a receiving architecture using the GPS. In terms of localization accuracy the GPS could show better performances than the proposed system even though accuracy decreases in presence of large Doppler shift. The proposed system is reusable and can be simplified by using the Ku band. The GPS systems suffers from delays in the STS program. ESA

N88-16275# Space Vector Corp., Northridge, Calif.
THE ILV: A NEW COMMERCIAL EXPENDABLE LAUNCH VEHICLE
M. D. Griffin and J. H. Jerger *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 441-448 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.

For related information see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance.* For space suits see *54 Man/System Technology and Life Support.*

No abstracts in this category.

17 SPACE COMM., SPACECRAFT COMM., COMMAND & TRACKING

Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

N88-16378*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
KNOWLEDGE-BASED MONITORING OF THE POINTING CONTROL SYSTEM ON THE HUBBLE SPACE TELESCOPE
Larry L. Dunham, Thomas J. Laffey, Simon M. Kao, James L. Schmidt, and Jackson Y. Read *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 95-100 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09F

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance, 39 Structural Mechanics,* and *16 Space Transportation.*

N88-15822# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
LABORATORY SIMULATION OF THE ELECTRODYNAMIC INTERACTIONS OF A TETHERED SATELLITE WITH AN IONOSPHERIC PLASMA
C. Bonifazi, J. P. Lebreton, G. Vannaroni, C. Cosmovici, R. Debrie, M. Hamelin, L. Pomathiod, and H. Arends (European Space Agency.

European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) Feb. 1986 28 p Presented at the Electrodynamic Panel of Applications of Tethers in Space Workshop, Venice, Italy, 15-17 Oct. 1985
(IFSI-86-3; ETN-88-91278) Avail: NTIS HC A03/MF A01

A plasma chamber was used to investigate the I-V characteristics of a conductive spherical body (10 cm diameter) in a plasma environment. The influence of a transversal magnetic field at 0.6 and 1.2 G on the sheath potential profile and current collection was investigated. Floating potential profiles were measured at 16 different radial distances from the test body up to 9 body radii in 8 different angular positions. The test body potential could be increased in the range from -200 V up to +100 V. Results confirm a decrease of electron current collection for increasing magnetic field. ESA

N88-15823*# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.
DEVELOPMENT OF AN EMULATION-SIMULATION THERMAL CONTROL MODEL FOR SPACE STATION APPLICATION Final Report
James G. Hartley and Gene T. Colwell Jan. 1988 88 p
(Grant NAG1-551)
(NASA-CR-182409; NAS 1.26:182409) Avail: NTIS HC A05/MF A01 CSCL 22B

The goal of this program is to develop an improved capability for comparing various techniques for thermal management in the space station. The work involves three major tasks: Develop a Technology Options Data Base (Task 1); Complete Development of a Space Station Thermal Control Technology Assessment Program (Task 2); and Develop and Evaluate Emulation Models (Task 3). Author

N88-15824# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
RADIATIVE HEAT TRANSFER SOLUTIONS IN PLANE-PARALLEL PARTICIPATING MEDIA: APPICATION TO MULTILAYER INSULATIONS FOR SPACE VEHICLES
L. A. Bambace, R. M. Cotta, and P. Carajilescov Jul. 1987 6 p Presented at the 9th Brazilian Congress of Mechanical Engineering, COBEM/87, Florianopolis, Brazil, 7-11 Dec. 1987
(INPE-4221-PRE/1101) Avail: NTIS HC A02/MF A01

The ideas in the Galerkin method for the solution of radiative transfer in plane parallel participating media are extended to allow for both specularly and diffusely reflecting boundaries. The technique is then utilized to solve the transversal heat transfer in multilayer insulation for aerospace applications. The relative accuracy of design type, approximate formulas are then established, and the effects of specularity are critically examined. Author

N88-15825# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
DOCKING/BERTHING SUBSYSTEM (DBS). DEVELOPMENT PART 1: LATCHING ANALYSIS Final Report
Paris, France ESA 27 Jul. 1987 127 p Revised Prepared in cooperation with Societe Anonyme Belge de Constructions Aeronautiques, Brussels, Belgium, and Sener S.A., Madrid, Spain
(Contract ESTEC-6409/85-NL-AN(SC))
(ESA-CR(P)-2479; ETN-88-91425) Avail: NTIS HC A07/MF A01

Based on a low impact docking concept and a latching mechanism concept, a docking/berthing subsystem and its operations were defined. A set of four breadboard models of the latch were manufactured and docking tests were performed on a four degree of freedom air bearing table. The tests demonstrate feasibility of the low impact docking concept under the test facility conditions. ESA

N88-15826# Hernandez Engineering G.m.b.H., Bonn (West Germany).
SAFETY PHILOSOPHY, POLICY, AND REQUIREMENTS FOR MANNED SPACEFLIGHT. VOLUME 1: EXECUTIVE SUMMARY
James Wiggins Paris, France ESA 4 Mar. 1987 11 p
(Contract ESTEC-6734/86-NL-MA(SC))
(HEG-0886/1036-Vol-1; ESA-CR(P)-2493-Vol-1; ETN-88-91426)
Avail: NTIS HC A03/MF A01

A philosophy and policy for manned space flight and upper level system requirements which would help program managers and system designers include safety considerations in all phases of the program life cycle were designed. The philosophy emphasizes the importance of human life in the space system. ESA

N88-15827# LITEF, Freiburg (West Germany).
ADVANCED GYROS IN SPACECRAFT CONTROL. DIGITAL CAPTURE LOOPS FOR DRY TUNED GYROS Final Report
C. Noxon, H. Klein, and W. Kroll Paris, France ESA May 1987 188 p
(Contract ESA-6119/84-NL-AN(SC))
(LITEF-120046; ESA-CR(P)-2484; ETN-88-91698) Copyright
Avail: NTIS HC A09/MF A01

Use of dry tuned gyros (DTG's), captured with digital loops, in spacecraft attitude measurement systems was studied. Digital mechanization was compared with analog loop based systems. Gyro performance requirements on typical satellite missions, and results of tests performed on digitally caged DTG's, covering various performance and environmental aspects are presented. It is concluded that digitally caged DTG's protected by shock mounts are suitable for medium accuracy spacecraft applications. ESA

N88-15828# Fokker B.V., Amsterdam (Netherlands). Space Div.
THERMAL STRUCTURAL CONTROL MODELLING TECHNIQUES Final Report
J. J. Wijker Paris, France ESA 12 Jun. 1986 110 p
(Contract ESTEC-5158/82-NL-PB(SC))
(FOK-TR-R-86-030; ESA-CR(P)-2496; ETN-88-91704) Avail: NTIS HC A06/MF A01

A link between the ASKA finite element program and the Dynamic and Control Analysis Package (DCAP) was developed. An interface software package called Interface DCAP (IFDCAP) was generated to transfer numerical data, describing the structural behavior of flexible bodies, between ASKA and DCAP. Ten test cases were defined in order to demonstrate the functioning of the interface program. Methodologies and links for data transfer between the System Improved Numerical Differencing Analyzer (SINDA) and ASKA were established. A temperature interpolation technique based on the prescribed average technique was developed. Using the finite element model of the structure with its conduction matrix, the thermal model temperatures are interpolated to obtain temperatures in all nodes of the structural model. A software package called SINAS to transfer SINDA nodal temperatures to the ASKA model nodes was written. Four test cases to demonstrate the functional performance of the interface package SINAS were defined. ESA

N88-15829*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Bioastronautics.
SPACE STATION ACCOMMODATIONS FOR LIFE SCIENCES RESEARCH FACILITIES. PHASE 1: CONCEPTUAL DESIGN AND PROGRAMMATICS STUDIES FOR MISSIONS SAAX0307, SAAX0302 AND THE TRANSITION FROM SAAX0307 TO SAAX0302. VOLUME 2: STUDY RESULTS Final Report
31 Mar. 1986 143 p
(Contract NAS8-35472)
(NASA-CR-179244; NAS 1.26:179244; LMSC/F071319A-Vol-2)
Avail: NTIS HC A07/MF A01 CSCL 22B

Lockheed Missiles and Space Company's conceptual designs and programmatics for a Space Station Nonhuman Life Sciences Research Facility (LSRF) are presented. Conceptual designs and programmatics encompass an Initial Orbital Capability (IOC) LSRF, a growth or follow-on Orbital Capability (FOC), and the transitional process required to modify the IOC LSFR to the FOC LSFR. The IOC and FOC LSFRs correspond to missions SAAX0307 and SAAX0302 of the Space Station Mission Requirements Database, respectively. Author

N88-15830*# Howard Univ., Washington, D. C. Dept. of Mechanical Engineering.
THE DYNAMICS AND CONTROL OF LARGE-FLEXIBLE SPACE STRUCTURES, PART 10 Final Report
Peter M. Bainum and A. S. S. R. Reddy Jan. 1988 199 p (Grant NsG-1414)
(NASA-CR-182426; NAS 1.26:182426) Avail: NTIS HC A09/MF A01 CSCL 22B

A mathematical model is developed to predict the dynamics of the proposed orbiting Spacecraft Control Laboratory Experiment (SCOLE) during the station keeping phase. The equations of motion are derived using a Newton-Euler formulation. The model includes the effects of gravity, flexibility, and orbital dynamics. The control is assumed to be provided to the system through the Shuttle's three torquers, and through six actuators located by pairs at two points on the mast and at the mass center of the reflector. The modal shape functions are derived using the fourth order beam equation. The generic mode equations are derived to account for the effects of the control forces on the modal shape and frequencies. The equations are linearized about a nominal equilibrium position. The linear regulator theory is used to derive control laws for both the linear model of the rigidized SCOLE as well as that of the actual SCOLE including the first four flexible modes. The control strategy previously derived for the linear model of the rigidized SCOLE is applied to the nonlinear model of the same configuration of the system and preliminary single axis slewing maneuvers conducted. The results obtained confirm the applicability of the intuitive and appealing two-stage control strategy which would slew the SCOLE system, as if rigid to its desired position and then concentrate on damping out the residual flexible motions. Author

N88-15831# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
HIGH RESOLUTION PICTURE TRANSMISSION (HRPT) DATA PROCESSING FROM NOAA SERIES SATELLITES [PROCESSAMENTO DOS DADOS HRPT DOS SATELITES DA SERIE NOAA]
Carlos Ho Shih Ning, Keiko Tanaka, Maria Roseli Cabral, Yoshihiro Yamazaki, and Yukitaka Nakamura Sep. 1987 26 p In PORTUGUESE; ENGLISH summary Presented at the 6th Plenaria da SELPER Conference, Gramado-RS, 10-15 Aug. 1986
(INPE-4372-PRE/1195) Avail: NTIS HC A03/MF A01

The TIROS-N is the first of a series of operational polar-orbiting meteorological satellites which was followed by NOAA-6 to 9. Aboard each spacecraft there are three passive sounding instruments: the High Resolution Infrared Radiation Sounder (HIRS-2), a radiometer with 19 channels in the infrared and 1 in the visible; the Microwave Sounding Unit (MSU), with 4 channels; and the Stratospheric Sounding Unit (SSU) with 3 channels. In addition to these instruments, which constitute the TIROS-N Operational Vertical Sounder (TOVS), these satellites transmit images from the Advanced Very High Resolution Radiometer (AVHRR) sensitive in the visible, near infrared, and middle infrared window regions. These data with telemetry and other instruments data constitute the High Resolution Picture Transmission (HRPT) data set. The HRPT data are transmitted in the S-band and received by parabolic antenna with 4 m diameter at the INPE/Cachoeira Paulista Meteorological Satellite Reception Station. The signals are processed in the minicomputer and digitized in CCT tapes at 1600 BPI density. The general description of TOVS and AVHRR data is presented together with the system developed for the files creation calibration applications programs to the meteorological satellites. Author

N88-15832# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ATTITUDE DETERMINATION OF ARTIFICIAL SATELLITES THROUGH JOINT APPLICATION OF STATIC AND DYNAMIC OPTIMAL ESTIMATION TECHNIQUES M.S. Thesis, 25 Jul. 1986 [DETERMINACAO DA ATITUDE DE SATELITES ARTIFICIAIS ATRAVES DA APLICACAO CONJUNTA DE TECNICAS DE ESTIMACAO OTIMA ESTATICA E DINAMICA]
Sebastiao Eduardo Co Varotto Oct. 1987 108 p In PORTUGUESE; ENGLISH summary
(INPE-4415-TDL/306) Avail: NTIS HC A06/MF A01

An algorithm is presented to be used for optimal attitude estimation of artificial satellites, suitable for real time applications. The attitude estimation at each sampling time is made in two phases. In the first, a preliminary estimation is obtained by a least squares method based only on instantaneous data from noninertial attitude sensors. This is done by using the algorithm known as QUEST (Quaternion Estimator). In the second phase, the preliminary estimate, after convenient treatment, is used as an observation to be processed by an extended Kalman filter. The real attitude of an artificial satellite simulated in a digital computer was used to test the procedure. The analysis of the results shows good performance of the procedure in terms of precision, robustness, and processing time, compared with other attitude estimation procedures. Author

N88-15833# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ATTITUDE DYNAMICS FOR SATELLITES STABILIZED THROUGH SPIN [DINAMICA DE ATITUDE PARA SATELITES ESTABILIZADOS POR ROTACAO]
Helio Koiti Kuga, Wilson Custodio Cane Silva, and Ulisses Thadeu Vieir Guedes Oct. 1987 31 p In PORTUGUESE; ENGLISH summary
(INPE-4403-NTE/275) Avail: NTIS HC A03/MF A01

A simplified dynamic modelling for the attitude motion of spin stabilized artificial satellites is proposed. Torques due to induced magnetic fields on the satellite, eddy currents, and gravity gradient are considered. The corresponding Euler equations are developed in convenient coordinates and solved by numerical integration. The FORTRAN program, as well as a user's manual, examples of use, and listings are described. Author

N88-15834# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ANALYSIS, DESIGN, CONSTRUCTION AND TESTING OF A REACTION WHEEL MODEL FOR SPACE APPLICATIONS M.S. Thesis, 13 Aug. 1986 [ANALISE, PROJETO, CONSTRUCAO E TESTES DE UM MODE LO DE RODA DE REACAO PARA APLICACOES ESPACIAIS]
Petronio NoronhadeSouza Sep. 1987 178 p In PORTUGUESE; ENGLISH summary
(INPE-4358-TDL/299) Avail: NTIS HC A09/MF A01

The study and design of a reaction wheel experimental model are presented. A reaction wheel is used in the fine control of artificial satellite attitude by exchanging angular momentum between the wheel and the satellite. Reaction wheels consist, basically, of an electric motor that drives the wheel and is commanded by an electronic module that controls its torque or its speed. This electronic module is connected to the satellite attitude and orbit control logic module. The work is divided into the following steps: analysis of the several momentum actuators focusing in particular ball and magnetic bearing reaction wheels; settlement of specifications and mechanical design; analysis, design, and digital simulation of the speed control system; characterization tests and their comparison with results for reaction wheels available in the market; and performance tests and their comparison with the results from digital simulation. Author

N88-15931*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ORBITAL TRANSFER VEHICLE STUDIES OVERVIEW
Don Perkinson *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 139-150 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 22B

N88-15943*# Sundstrand Corp., Rockford, Ill.
ZERO-G THERMODYNAMIC VENT SYSTEM FOR SHUTTLE/CENTAUR

Richard E. Niggemann *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 369-376 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 22B

N88-16044# Assurance Technology Corp., Carlisle, Mass.
DESIGN AND TEST OF A SPACECRAFT INSTRUMENT SHOCK ISOLATOR
D. Schiff, N. Jones, and S. Fox *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 29-45 (For primary document see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 22B

N88-16099# Joint Publications Research Service, Arlington, Va.
GYROSTABILIZER SYSTEM OF KVANT MODULE
N. Sheremetyevskiy and B. Chertok *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 99-100 Transl. into ENGLISH from Pravda (Moscow, USSR), 6 Sep. 1987 p 3 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16102# Joint Publications Research Service, Arlington, Va.
SELECTION OF EFFICIENT CORRECTING MOTOR FOR AN ARTIFICIAL EARTH SATELLITE Abstract Only
M. A. Kuzmin and Yu. N. Chilin *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 105 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 204-215 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxilliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles.*

N88-15835*# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
SPACE STATION PROPULSION TECHNOLOGY Annual Progress Report No. 2, 24 May 1986 - 2 Oct. 1987
A. M. Norman, G. L. Briley, and S. A. Evans 8 Oct. 1987 34 p
(Contract NAS8-36418)
(NASA-CR-179260; NAS 1.26:179260) Avail: NTIS HC A03/MF A01 CSCL 21H

The objectives of this program are to provide a demonstration of hydrogen/oxygen propulsion technology readiness for the initial operational capability (IOC) space station application, specifically gaseous hydrogen/oxygen and warm hydrogen thruster concepts, and to establish a means for evolving from the IOC space station propulsion system (SSPS) to that required to support and interface with advanced station functions. These objectives were met by analytical studies and by furnishing a propulsion test bed to the Marshall Space Flight Center for testing. Author

N88-15836*# Remtech, Inc., Huntsville, Ala.
SSME ENVIRONMENT DATABASE DEVELOPMENT Final Report
John Reardon Dec. 1987 22 p
(Contract NAS8-36184)
(NASA-CR-179245; NAS 1.26:179245; RTR-166-04) Avail: NTIS HC A03/MF A01 CSCL 21H

The internal environment of the Space Shuttle Main Engine (SSME) is being determined from hot firings of the prototype engines and from model tests using either air or water as the test fluid. The objectives are to develop a database system to facilitate management and analysis of test measurements and results, to enter available data into the the database, and to analyze available data to establish conventions and procedures to provide consistency in data normalization and configuration geometry references. Author

N88-15837# Lawrence Livermore National Lab., Calif. Environmental Sciences Div.
HYDROGEN CHLORIDE MEASUREMENTS IN LAUNCH-VEHICLE EXHAUST CLOUDS
Tom McRae, Randall Kennedy, Darrell Garvis, and Mark D. Smith (Air Force Engineering and Services Center, Tyndall AFB, Fla.) May 1987 15 p Presented at the SPIE Technical Symposium on Optics and Optoelectronics, Orlando, Fla., 23-24 May 1987
(Contract W-7405-eng-48)
(DE87-011552; UCRL-95349; CONF-870584-12) Avail: NTIS HC A03/MF A01

An Air Force-sponsored effort to develop a versatile field sensor for the measurement of hydrogen chloride (HCl) vapors from rocket launches is described. Lawrence Livermore National Laboratory (LLNL) is developing an infrared HCl detector with ppB range sensitivities to be used for monitoring HCl during space vehicle launches at Vandenberg AFB. HCl deposition on the community neighboring Vandenberg AFB can involve costly litigation. Monitoring is necessary to determine the amount of HCl and if it presents hazardous situations or detrimental effects. The sensor developed by LLNL is an in situ sampler, which can constantly monitor a rapidly changing concentration of HCl in air (response time is one second). It is a four-band differential absorption instrument, allowing for corrections due to system electronic and optical variations, as well as for variations in the background concentrations of methane and water vapor that also absorb at HCl wavelengths. There is also the possibility of measuring HCl droplets with this type of sensor. The detector's variable pathlength-absorption region allows for HCl detection down to 200 ppB. The instrument is remotely operable, a necessity given the rugged Vandenberg terrain and limitations placed on personnel access to the launch area. The data from the battery-powered sensor are transmitted via radio link to a central base station where they are displayed and recorded using an IBM PC. DOE

N88-15838*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATUS OF 20 kHz SPACE STATION POWER DISTRIBUTION TECHNOLOGY
Irving G. Hansen Jan. 1988 12 p Presented at the Applied Power Electronics Conference and Exposition (APEC 88), New Orleans, La., 1-5 Feb. 1988; sponsored by IEEE
(NASA-TM-100781; E-3951; NAS 1.15:100781) Avail: NTIS HC A03/MF A01 CSCL 10B

Power Distribution on the NASA Space Station will be accomplished by a 20 kHz sinusoidal, 440 VRMS, single phase system. In order to minimize both system complexity and the total power coversion steps required, high frequency power will be distributed end-to-end in the system. To support the final design of flight power system hardware, advanced development and demonstrations have been made on key system technologies and components. The current status of this program is discussed.
Author

N88-16272# Bristol Aerospace, Ltd., Winnipeg (Manitoba).
PAST, PRESENT AND FUTURE ROLE OF BLACK BRANT ROCKET SYSTEMS TO SUPPORT INTERNATIONAL SPACE SCIENCE PROGRAMS
B. R. Payne and H. G. Sevier *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 427-432 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

N88-16273# Saab-Space A.B., Linkoeping (Sweden).
GUIDANCE OF HIGH-ALTITUDE SOUNDING ROCKETS USING THE S19 AND SPINNING ROCKET ALTITUDE CONTROL (SPINRAC) SYSTEMS
L. Hall *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 433-436 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

N88-16274# British Aerospace Dynamics Group, Bristol (England). Space and Communications Div.
SKYLARK SOUNDING ROCKET DEVELOPMENT-SKYLARK 8
J. A. Ellis *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 437-440 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

23 CHEMISTRY AND MATERIALS (GENERAL)

N88-15839# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
THE SYNTHESIS AND CHARACTERIZATION OF SOME RARE EARTH ARSENIDES
Juliet N. Schurr 10 Sep. 1987 82 p
(Contract F04701-85-C-0086)
(AD-A186445; TR-0086(6935-07)-1; SD-TR-87-40) Avail: NTIS HC A05/MF A01 CSCL 07B

Solid solutions of a new material, Holmium Niobium Arsenide, have been synthesized, and the binary arsenides NdAs and HoAs have been prepared. Chemical analyses have shown that both were arsenic deficient. Lattice parameters were determined for NdAs and HoAs. It has been established that a range of arsenic solubility exists in the binary arsenides where no change in lattice parameter is observed. High temperature thermal analyses were conducted on all arsenides. NdAs and HoAs exhibited arsenic volatilization upon heating. GRA

24 COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.
For ceramic materials see *27 Nonmetallic Materials*.

N88-15840# Research Inst. of National Defence, Stockholm (Sweden).
EFFECTS OF AVIATION FLUIDS ON FIBER COMPOSITE MATERIAL
Elise Halloff and Bo Holmberg Sep. 1987 15 p In SWEDISH; ENGLISH summary Sponsored by the Swedish Material Administration of Armed Forces (Air Material Dept.)
(FOA-C-20674-2.6; ISSN-0347-3694; ETN-88-91399) Avail: NTIS HC A03/MF A01

Specimens of carbon fiber composite materials were exposed to 10 aircraft fluids: oils, fuels, hydraulic fluids, antiicing fluids, coolants, and fire retarding agents, at room temperature and at elevated temperatures. The effect was determined in terms of changes of the mechanical properties of the exposed specimens. This effect is very limited, and no important differences are noted among the fluids in spite of their different chemical composition. ESA

N88-15841# Research Inst. of National Defence, Stockholm (Sweden).
THE EFFECT OF THERMAL SHOCK ON CARBON FIBER EPOXY COMPOSITES
Bo Holmberg Sep. 1987 16 p In SWEDISH; ENGLISH summary Sponsored by the Swedish Material Administration of Armed Forces (Air Material Dept.)
(FOA-C-20675-2.6; ISSN-0347-3694; ETN-88-91400) Avail: NTIS HC A03/MF A01

A carbon fiber composite material was cycled between plus 110 C and minus 60 C after different treatments. The modulus of elasticity is 10 percent lower for treated material; thermal cycling of a moisture saturated material does not affect the ability for absorbing moisture; tensile strength is not affected by the thermal shock, nor by a moisture content less than 1 percent; tensile deformation up to 75 percent of the proportional limit does not change the ability of the material to absorb moisture. ESA

N88-15842# Societe Nationale Elf Aquitaine, Pau (France). Direction des Recherches.
STRUCTURAL STUDY OF THE IMPREGNATING RESINS OF THE TYPE TGMDA/DDS Final Report [ETUDE STRUCTURALE DES RESINES D'IMPREGNATION DU TYPE TGMDA/DDS]
P. Horny Mar. 1986 50 p In FRENCH
(Contract DRET-85-355)
(ETN-88-91616) Avail: NTIS HC A03/MF A01

A TGMDA - DDS resin mixing procedure was developed to allow a fast homogeneization without advancing the chemical reaction. Polymerization tests were carried out, using different heating cycles and the properties of the resulting polymer were measured. The measurements included moisture absorption, solvent extraction, and thermal characteristics. It is shown that the use of optical microscopy with polarized light can define accurately the optimum mixing procedure. At a temperature of 140 C a good mixture is obtained in 5 min with very little chemical reaction. ESA

N88-15843# Ecole Centrale de Lyon (France). Lab. de Mecanique des Solides.
CONTRIBUTION TO MODELING FLEXION FATIGUE DAMAGE IN UNIDIRECTIONAL COMPOSITE MATERIALS Ph.D. Thesis [CONTRIBUTION A LA MODELISATION DE L'ENDOMMAGEMENT DE FATIGUE EN FLEXION DANS LES MATERIAUX COMPOSITES UNIDIRECTIONNELS]
Bambang Sugeng Subagio 1987 191 p In FRENCH; ENGLISH summary
(ECL-87-12; ETN-88-91623) Avail: NTIS HC A09/MF A01

Local damage laws are investigated using the Kachanov Rabotnov theory and global mechanical measurements in fixed stress or strain flexion tests. The model is identified from results obtained with glass-epoxy composite materials in three point flexion tests. The dispersion notion is introduced applying a Weibull law to one of the coefficients of the damage evolution law. The results show that identifying damage laws is possible if the dispersion of mechanical properties is included in the model. ESA

N88-15844# Argonne National Lab., Ill.
NONDESTRUCTIVE CHARACTERIZATION OF CERAMIC COMPOSITE WHISKERS WITH NEUTRON DIFFRACTION AND ULTRASONIC TECHNIQUES
D. S. Kupperman, S. Majumdar, S. R. MacEwen, R. L. Hitterman, J. P. Singh, R. A. Roberts, and J. L. Routbort Jul. 1987 17 p Presented at the Review of Progress in Quantitative NDE, Williamsburg, Va., 21 Jun. 1987
(Contract W-31-109-eng-38)
(DE88-003075; CONF-870691-7) Avail: NTIS HC A03/MF A01

This paper presents some results of a program in which the characterization and control of interfacial bonds in composites are

being investigated. The General Purpose Powder Diffractometer (GPPD) at the Intense Pulsed Neutron Source (IPNS) have been employed to measure residual strains in Al2O3/SiC, ceramic-ceramic composite by neutron diffraction techniques from which stresses at the fiber-matrix interface may be calculated. Results of this experiment and initial results employing ultrasonic techniques to assess whisker-matrix bonding are discussed.
DOE

N88-15845# Texas Univ., Austin. Center for Materials Science and Engineering.
INTERFACE CHARACTERISTICS AND THE MECHANICAL PROPERTIES OF METAL MATRIX COMPOSITES Technical Report, 1 Aug. 1984 - 31 Jul. 1987
Harris L. Marcus and Llewellyn K. Rabenberg 28 Sep. 1987 172 p
(Contract N00014-84-K-0687)
(AD-A186441; UTCMSE-87-3) Avail: NTIS HC A08/MF A01 CSCL 11D

The research reported here is concerned with the relationships between interface characteristics and mechanical properties of metal matrix composites. Because composite interfaces are, in general, complex non-equilibrium structures, this research has emphasized the use of simplified, model specimens and direct characterization techniques to extract a range of information from the interfaces themselves. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*.

N88-15846*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN ANALYTICAL STUDY OF THE HYDROGEN-AIR REACTION MECHANISM WITH APPLICATION TO SCRAMJET COMBUSTION
Casimir J. Jachimowski Feb. 1988 18 p
(NASA-TP-2791; L-16372; NAS 1.60:2791) Avail: NTIS HC A03/MF A01 CSCL 07D

A chemical kinetic mechanism for the combustion of hydrogen has been assembled and optimized by comparing the observed behavior as determined in shock tube and flame studies with that predicted by the mechanism. The reactions contained in the mechanism reflect the current state of knowledge of the chemistry of the hydrogen/air system, and the assigned rate coefficients are consistent with accepted values. It was determined that the mechanism is capable of satisfactorily reproducing the experimental results for a range of conditions relevant to scramjet combustion. Calculations made with the reaction mechanism for representative scramjet combustor conditions at Mach 8, 16, and 25 showed that chemical kinetic effects can be important and that combustor models which use nonequilibrium chemistry should be used in preference to models that assume equilibrium chemistry. For the conditions examined the results also showed the importance of including the HO2 chemistry in the mechanism. For Mach numbers less than 16, the studies suggest that an ignition source will most likely be required to overcome slow ignition chemistry. At Mach 25, the initial temperature and pressure was high enough that ignition was rapid and the presence of an ignition source did not significantly affect reaction rates. Author

N88-15847# Brigham Young Univ., Provo, Utah. Dept. of Chemical Engineering.
CHARACTERIZING PARTICLE COMBUSTION IN A RIJKE BURNER Interim Report, Feb. 1986 - May 1987
J .C. Finlinson, R. W. Nelson, M. A. Nelson, and M. W. Beckstead 29 May 1987 24 p
(Grant AF-AFOSR-0157-83)
(AD-A186157; AFOSR-87-0961TR) Avail: NTIS HC A03/MF A01 CSCL 20A

The principle objective of this study is to identify and develop an understanding of the mechanisms whereby acoustic suppressants modify an acoustic wave. The experimental bases for the technical approach of this study is a Rijke burner which generates combustion oscillations. During the past year three major modifications were made to the Rijke burner to facilitate obtaining more reproducible data: (1) The cooling jacket was rebuilt to give better heat transfer characteristics, and a flowmeter was incorporated to allow a quantitative control of the cooling water flow. (2) A digital data acquisition system was interfaced with the burner to allow monitoring more variables, and to improve data reduction techniques. (3) A new damping device consisting of a butterfly valve and a sound absorbing cone below the burner was developed to allow greater damping. Acoustic growth rate data have been obtained: a nominal frequency of 1200 Hz varying the mass flow rate, the oxidizer/fuel ratio, and the relative amount of nitrogen. In all cases, the growth rate increases as the energy release rate (or temperature) increases. These data will now be compared to the previously developed model to better understand the physical mechanisms driving the acoustic oscillations. The model is also being modified to incorporate various submodels for different types of particulates. GRA

N88-15848# AeroChem Research Labs., Inc., Princeton, N. J.
IONIC MECHANISMS OF SOOT FORMATION IN FLAMES Final Report, 15 Sep. 1983 - 31 Sep. 1986
H. F. Calcote and D. G. Keil Jun. 1987 59 p
(Contract F49620-83-C-0150)
(AD-A186195; AFOSR-87-1197TR) Avail: NTIS HC A04/MF A01 CSCL 21B

Experimental measurements have been made and interpreted in acetylene/oxygen and benzene/oxygen/argon flames at 2.7 kPa, and an unburned flow velocity of 50 cm/s with the objective of evaluating the ionic mechanism of soot nucleation. This mechanism postulates that chemi-ions are precursors of soot and that the initial reactions in the soot and nucleation process are ion-molecule reactions in which molecular ions continually increase in size until they are neutralized by ion combination. Total ion profiles were determined by Langmuir probe; individual ion profiles were determined by molecular ion sampling mass spectrometry up to about mass 600; temperature profiles were determined by radiation corrected thermocouples. It is demonstrated that the ion concentration is greater than the concentration of soot particles; and ions decay as soot is produced. In the acetylene/oxygen, the ion-molecule reaction rates are measured and compared with other measured and calculated rates. It is demonstrated that these rates are rapid at flame temperatures. Some major differences were found in the features of benzene and acetylene ion profiles that remain to be explained. The experiments are strongly supportive of the ion mechanism of soot formation in flames. GRA

N88-15849# Texas A&M Univ., College Station. Dept. of Mechanical Engineering.
NON-STEADY GROUP COMBUSTION OF A CLOUD OF CHAR PARTICLES
S. C. Ramalingam and K. Annamalai 1987 28 p Presented at the Symposium on Technology of Glass, Ceramic, Or Glass-Ceramic To Metal Sealing, Boston, Mass., 13 Dec. 1987
(Contract DE-FG22-85PC-80528)
(DE87-010773; CONF-871207-3) Avail: NTIS HC A03/MF A01

Group theory has been recently proposed for the combustion modeling of char/carbon particles. To gain a basic understanding of the group behavior, a simple model such as the steady state analysis of a spherically symmetric cloud of char/carbon particles burning in quiescent air, was used to obtain results for the cloud burning rate. The most important objective was to relate the results from individual particle combustion (IPC) model to Group Combustion (GC) model. The present work concerns with the modeling of a non-steady (NS) group combustion of a cloud of char particles. The results presented here are for the frozen case where the gas phase CO oxidation reaction and the CO2 reduction

reaction at the char surface are suppressed. Using a computer code developed for the study of non-steady group combustion, steady state was simulated and the results were then compared with the explicit results generated in the previous work. The steady simulation was undertaken to prove the reliability of the computer model to generate transient results, as there exists no literature on transient group combustion. Secondly, the transient results for G = 100 and 10 are also presented and comparison with the steady state results for the same conditions are shown. It is found that the correction factor to the IPC model obtained with steady state group combustion theory remains approximately the same even for the NS case for G = 100. However, for G = 10, the NS results differ considerably from the quasi-steady (QS) case, due to low bulk gas temperature for dilute clouds which leads to kinetics controlled combustion, whereas the QS results are based on diffusion controlled combustion. Further, it is found that apart from the ambient temperature and the particle size, the cloud conditions also dictate whether the particles under kinetics or diffusion controlled combustion. DOE

N88-15850# Rockwell International Corp., Golden, Colo.
INTERRELATION AND MEASUREMENT OF FORMABILITY, STRENGTHENING, AND THERMOMECHANICAL PROCESSING UNDER METALWORKING CONDITIONS
R. J. Jackson, ed. and R. L. Thomas, ed. 14 Sep. 1987 46 p
(Contract DE-AC04-76DP-03533)
(DE88-002485; RFP-4098) Avail: NTIS HC A03/MF A01

A single test was developed that yields the formability, strengthenability, and thermomechanical processability of a material. The test was based on observations in coupon rolling that, once a base elasticity is exceeded, the material thickness reduction is linear with respect to roll gap reduction at all roll gap settings, and the log of the hardness is linear with respect to the material thickness or roll gap reduction. The first observation suggested measuring a plastic index, P (the slope), and an elastic index, E (the x-intercept), and combining both to obtain a formability index defined as $F^* = (P/E)0.1$. The second observation suggested measuring a hardening index, H (the slope), and a hardness index, I, (the initial hardness), and combining both to obtain a strengthenability index defined as $S^* = H/I$. Both indices are measured while the material is being thermomechanically processed through a wide range of tooling geometrics (gap clearances). This allows a measure of the ease with which the material can be formed and strengthened simultaneously, i.e., a measure of the thermomechanical processability, TMP*. This quantity was defined as $TMP^* = F^* \cdot S^*$. DOE

N88-15851*# Ultrasystems, Inc., Irvine, Calif.
IMPROVED PERFLUOROALKYLETHER FLUID DEVELOPMENT Final Report, 1 Mar. 1985 - 30 Sep. 1987
K. L. Paciorek, S. R. Masuda, J. H. Nakahara, and R. H. Kratzer 30 Nov. 1987 55 p
(Contract NAS3-24632)
(NASA-CR-180872; SN-3504-F; NAS 1.26:180872) Avail: NTIS HC A04/MF A01 CSCL 07D

The objective of this program was to optimize and scale up the linear perfluoroalkylether stabilization process and to provide test data regarding the fluids' thermal oxidative stability in the presence of metal alloys. The stabilization of Fomblin Z-25 was scaled up to 300 g of fluid. The modified fluid was stable at 316 C in oxygen in the presence of M-50 alloy for more than 24 hrs but less than 40 hrs; the amount of volatiles produced after 24 hrs was 5.5 mg/g. In the presence of Ti(4Al,4Mn) alloy, under the above conditions, following an exposure of 24 hrs, the amount of volatiles formed was 6.2 mg/g; 56 hrs exposure yielded 13.9 mg/g. The commercial fluid at 288 C (in oxygen) in the presence of M-50 after 15 hrs of exposure decomposed extensively, 342 mg/g; in the presence of Ti(4Al,4Mn) alloy after only 8 hrs at 288 C, the amount of volatiles was 191 mg/g. Formulation of the commercial fluid with C2PN3 additive was not as effective as the stabilization processing. All the perfluoroalkylether fluids studied were stable in nitrogen at 343 C. The thermal oxidative stability in the absence of metal alloys varied, with Aflunox exhibiting the best behavior. All the fluids were degraded in oxygen at 316 C during 24 hrs exposure to Ti(4Al,4Mn) alloy with the exception of a perfluoroalkylether substituted triazine and the modified Z-25. Author

N88-15852*# Texas A&M Univ., College Station. Lab. for Surface Electrochemistry.
ELECTROCHEMICAL PROCESSING OF SOLID WASTE Annual Report
J. OM. Bockris, G. D. Hitchens, and L. Kaba Feb. 1988 42 p
(Grant NAG9-192)
(NASA-CR-182413; NAS 1.26:182413) Avail: NTIS HC A03/MF A01 CSCL 07D

The investigation into electrolysis as a means of waste treatment and recycling on manned space missions is described. The electrochemical reactions of an artificial fecal waste mixture was examined. Waste electrolysis experiments were performed in a single compartment reactor, on platinum electrodes, to determine conditions likely to maximize the efficiency of oxidation of fecal waste material to CO2. The maximum current efficiencies for artificial fecal waste electrolysis to CO2 was found to be around 50 percent in the test apparatus. Experiments involving fecal waste oxidation on platinum indicates that electrodes with a higher overvoltage for oxygen evolution such as lead dioxide will give a larger effective potential range for organic oxidation reactions. An electrochemical packed column reactor was constructed with lead dioxide as electrode material. Preliminary experiments were performed using a packed-bed reactor and continuous flow techniques showing this system may be effective in complete oxidation of fecal material. The addition of redox mediator Ce(3+)/Ce(4+) enhances the oxidation process of biomass components. Scientific literature relevant to biomass and fecal waste electrolysis were reviewed. Author

N88-15853*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE EFFECT OF MICROGRAVITY ON FLAME SPREAD OVER A THIN FUEL M.S. Thesis, Case Western Reserve Univ., Cleveland, Ohio, Aug. 1987
Sandra L. Olson Dec. 1987 49 p
(NASA-TM-100195; E-3785; NAS 1.15:100195) Avail: NTIS HC A03/MF A01 CSCL 21B

A flame spreading over a thermally thin cellulose fuel was studied in a quiescent microgravity environment. Flame spread over two different fuel thicknesses was studied in ambient oxygen-nitrogen environments from the limiting oxygen concentration to 100 percent oxygen at 1 atm pressure. Comparative normal-gravity tests were also conducted. Gravity was found to play an important role in the mechanism of flame spread. In lower oxygen environments, the buoyant flow induced in normal gravity was found to accelerate the flame spread rate as compared to the microgravity flame spread rates. It was also found to stabilize the flame in oxidizer environments, where microgravity flames in a quiescent environment extinguish. In oxygen-rich environments, however, it was determined that gravity does not play an important role in the flame spread mechanism. Fuel thickness influences the flame spread rate in both normal gravity and microgravity. The flame spread rate varies inversely with fuel thickness in both normal gravity and in an oxygen-rich microgravity environment. In lower oxygen microgravity environments, however, the inverse relationship breaks down because finite-rate kinetics and heat losses become important. Two different extinction limits were found in microgravity for the two thicknesses of fuel. This is in contrast to the normal-gravity extinction limit, which was found to be independent of fuel thickness. In microgravity the flame is quenched because of excessive thermal losses, whereas in normal gravity the flame is extinguished by blowoff. Author

N88-15854# Sandia Corp., Livermore, Calif. Combustion Research Facility.
VELOCITY AND DENSITY MEASUREMENTS IN A TURBULENT NONPREMIXED FLAME WITH COMPARISON TO NUMERICAL MODEL PREDICTIONS

R. W. Dibble, R. W. Schefer, J. Y. Chen, V. Hartmann, and W. Kollmann Aug. 1987 154 p
(Contract DE-AC04-76DR-00789)
(DE87-014695; SAND-85-8233) Avail: NTIS HC A08/MF A01

This paper documents and codifies a data base that consists of extensive laser-based measurements of velocity and density in a turbulent nonpremixed flame of hydrogen in air. These data were obtained in the Turbulent Combustion Tunnel Facility located at the Combustion Research Facility of Sandia National Laboratories. In these flames, the chemical reaction rates for the major species are greater than the mixing rates and, therefore, the data reported here can be used for improvement of models of turbulent mixing with large heat release without the additional complication of finite rate chemical kinetics. As an example of model improvement, comparisons of the data base with predictions of a numerical model of turbulent reacting flow are made. DOE

N88-15855*# National Aeronautics and Space Administration, Washington, D.C.
EQUATION OF STATE OF CONDENSED MATERIALS PHYSICAL PRINCIPLES AND APPLICATIONS Ph.D. Thesis - Ecole Centrale, Lyon, France, Dec. 1986
P. Vinet Jan. 1988 152 p Transl. into ENGLISH of Equation dEtat des Materiaux Condenses: Principes Physiques et Applications, Lyon, France, Order No. ECL-86-15, Dec. 1986 p 1-170 Transl. by The Corporate Word, Inc., Pittsburgh, Pa.
(Contract NASw-4006)
(NASA-TT-20007; NAS 1.77:20007; ECL-86-15) Avail: NTIS HC A08/MF A01 CSCL 07D

It is shown that, during a compression experiment, the isothermal equation of state of condensed materials, solids or liquids, is of a universal form. This single form can describe very different types of materials, metals, ionic or covalent solids, and van der Waals crystals as well. Some simple analytical expressions are proposed which allow accurate predictions (in the absence of phase transition) of the variations of numerous thermodynamic quantities with volume and temperature, i.e., pressure, isothermal bulk modulus, its partial derivative with respect to pressure, and thermal expansion. Some important applications are investigated: lubricants under pressure and their glassy phase transitions; the effect of pressure on shear moduli in mechanical contacts; and the effect of pressure on melting temperatures. In addition, explanations are given in terms of universality of free energy versus interatomic separation. Especially, the effects of electronic structure and atomic bonding are highlighted. Author

N88-15793*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHEMICAL REACTING FLOWS
Edward J. Mularz and Peter M. Sockol *In its* Aeropropulsion '87. Session 3: Internal Fluid Mechanics Research Nov. 1987 20 p (For primary document see N88-15790 08-07)
Avail: NTIS HC A04/MF A01 CSCL 21B

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N88-15856# Technical Research Centre of Finland, Espoo. Metals Lab.
ON THE RELATIONS BETWEEN CYCLIC CONTRACTION RATIO FLOWSTRESS AND DEFORMATION MECHANISMS IN BAINITIC CrMoV STEELS Ph.D. Thesis - Helsinki Univ., Espoo, Finland
Klaus Rahka (Helsinki Univ. Technology, Otaniemi, Finland) Apr. 1987 105 p
(DE87-753043; VTT-PUBL-36; ISBN-951-38-2855-7; ISSN-0358-5069) Avail: NTIS (US Sales Only) HC A06/MF A01

The cyclic diametral strain and stress response of macroscopically untextured (nominally isotropic) bainitic Cr-Mo-V steels has been studied. The total axial strain amplitudes were controlled and chosen so that a range of ratios of plastic and elastic elongations were used extending from 0.04 to 5. The trend of the cyclic diametral strain was sometimes found to drastically deviate from the commonly used Poisson's ratio when the ratio of plastic and elastic elongation was around 3 for the uncycled material. The unusual initial increase in cyclic contraction ratio for these conditions was attributed to strain concentration and the decrease to strain decentration. A condition for these unpredictable macroscopic effects seems to be that the effective strengthening structure should be sufficiently unstable during the cyclic strain applied. At room temperature fatigue slip bands of high local density and number are created in these conditions. At elevated temperature applied strains larger than 0.3 percent give rise to an increasing mechanically activated dynamic recovery which operates despite a dense carbide dispersion. The amount of recovery and simultaneous dislocation annihilation increase and act to lower the flow strength with rising strain. Their extent depend on the strain rate. An apparent maximum in dynamic recovery was observed as a minimum in cyclic yield strength at the same strain for which the pronounced unpredictable diametral strain was observed. Similar diametral strain effects in monotonic tension tests on different materials reported in the published literature indicate that the effects are most probably related to the particular dominant mode of slip at strain levels for which the ratio of plastic and elastic strain (e sub p/e sub E) is around three. Slip is then dominantly planar. DOE

N88-15857# Materials Handling Research Inst., Beijing (China).
ANALYSIS OF LOAD-BEARING CAPACITY OF NITRIDED LAYER
Y. Xun and X. Zhang 1986 12 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-144176; ISTIC-TR-C-000085) Avail: NTIS HC E03/MF E01 CSCL 11F

The effects of steel grade (38CrMoAl, 42CrMo, 40Cr) and the technological parameters in ionitriding on the contact fatigue behavior of the nitrided layer are studied. The surface failures of contact fatigue are analyzed both macroscopically and microscopically. It is found that contact fatigue life is related not only to surface hardness of a nitrided part but also to the hardness gradient of its diffusion layer. The depth of effective hardening layer, delta(eff) is an important parameter. The contact fatigue life increases with delta(eff). Experimental results indicate that 40Cr yields deeper and relatively plastic hardened case after ionitriding. It exhibits the longest life among the three steels studied. GRA

N88-15858# University of Iron and Steel Technology, Beijing (China). Faculty of Materials.
RARE EARTH ELEMENTS IN HEAT TREATABLE STEELS
S. Zhang and C. Wu 1986 15 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-144002; ISTIC-TR-C-000084) Avail: NTIS HC E03/MF E01 CSCL 11F

Alloying functions of rare earth metals (REM) in iron and steel are discussed. REM have limited solid solubilities in iron, but they strongly tend to segregate to the grain boundaries. They effect phase transformations in steels and also the morphologies of the transformation products. REM have a significant influence on the mechanical properties of steels, particularly on those closely related to the properties of the grain boundaries. GRA

N88-15859 British Library Lending Div., Boston Spa (England).
METHODS OF IMPROVING COMPACTING QUALITY OF INTRICATELY SHAPED POWDER COMPONENTS
L. M. Glukhov, V. G. Bakhtin, A. B. Kudrin, V. D. Pirog, and V. I. Mylnikov [1988] 9 p Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedeniy Metallurgiya (USSR), no. 3, 1987 p 71-75
(BLL-M-37412-(5828.4)) Avail: British Library Lending Div., Boston Spa, United Kingdom

It is demonstrated that during compacting in an intricately shaped die the green compact loses continuity in the direction of the pressing force at any fillet of the cross-section, this being

caused by a concentration of shear stresses in this zone. Increasing the fillet radius where the sections meet lowers the probability of stacked crack initiation right up to a density of theta = 0.45. The application of ultrasonic vibrations at a point of deformation concentration prevents the formation of cracks in the investigated range of average relative densities (0.25 to 0.5). This creates promising possibilities with respect to the devising of a practice permitting expansion of the category of powder components exhibiting high strengths and special properties. Author

N88-15860 British Library Lending Div., Boston Spa (England).
INVESTIGATIONS IN FIELD OF SURFACE FORCES IN METALLURGY
Yu. A. Minaev [1988] 13 p Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedeniy Metallurgy (USSR), no. 3, 1987 p 7-11
(BLL-M-47406-(5828.4)) Avail: British Library Lending Div., Boston Spa, United Kingdom

Research on physical chemistry of surface phenomena and dispersed systems in connection with intensification of metallurgical processes is examined. The results of a number of developments in this field are presented. Thermodynamic stability, thermodynamics of films, kinetic phenomena, relation between phenomena in adsorption layer and mass transfer, and development of theory of surface phenomena are discussed. B.G.

N88-15861*# Alabama Univ., Huntsville. Dept. of Chemistry.
TRANSPARENT METAL MODEL STUDY OF THE USE OF A CELLULAR GROWTH FRONT TO FORM ALIGNED MONOTECTIC COMPOSITE MATERIALS Final Report
William F. Kaukler Feb. 1988 8 p
(Grant NAG8-069)
(NASA-CR-182414; NAS 1.26:182414) Avail: NTIS HC A02/MF A01 CSCL 11F

The purpose of this work was to resolve a scientific controversy in the understanding of how second phase particles become aligned during unidirectional growth of a monotectic alloy. A second aspect was to make the first systematic observations of the solidification behavior of a monotectic alloy during cellular growth in-situ. This research provides the first systematic transparent model study of cellular solidification. An interface stability diagram was developed for the planar to cellular transition of the succinonitrile glycerol (SNG) system. A method was developed utilizing Fourier Transform Infrared Spectroscopy which allows quantitative compositional analysis of directionally solidified SNG along the growth axis. To determine the influence of cellular growth front on alignment for directionally solidified monotectic alloys, the planar and cellular growth morphology was observed in-situ for SNG between 8 and 17 percent glycerol and for a range of over two orders of magnitude G/R. B.G.

N88-15862# Institut Franco-Allemand de Recherches, St. Louis (France).
CRITICAL ANALYSIS OF THE DYNAMIC BEHAVIOR LAWS FOR METALLIC MATERIALS [ANALYSE CRITIQUE DES LOIS DE COMPORTEMENT DYNAMIQUE DES MATERIAUX METALLIQUES]
S. Dujardin 20 Aug. 1986 50 p In FRENCH
(Contract DRET-86-1153)
(ISL-NB-401/86; ETN-88-91639) Avail: NTIS HC A03/MF A01

Published behavior laws for metals are reviewed and their thoretical base, validity domain, and application case are discussed. The dynamical tests used for the validation of the laws are described. ESA

N88-15863# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ELECTROFORMATION: PRINCIPLE ELECTROCHEMICAL PROCESS OF ELECTRODEPOSITION AND ELECTROFORMATION OF COPPER [ELETROFORMACAO: PRINCIPIOS ELETROQUIMICOS PROCESSO DE ELETRODEPOSICAO E ELETROFORMACAO DE COBRE]
Maria doCarmodeAndradeNono Sep. 1987 54 p In PORTUGUESE; ENGLISH summary
(INPE-4374-NTE/274) Avail: NTIS HC A04/MF A01

The electroforming of metals under practical and electrochemical points of view is examined. The basic study of electrochemical principles provides a greater understanding of the metal electrodeposition phenomena. The parameters of this process and the related materials are correlated with the mechanical and electrical properties, and with the microstructural characteristics of electrodeposits. A special treatment is given to copper electroformation from acid copper sulfate baths. Author

N88-15864# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COPPER ELECTROFORMING FROM ACID SULFATE BATHS: PRELIMINARY STUDIES [ELETROFORMACAO DE COBRE A PARTIR DE BANHOS ACIDOS DE SULFATO: ESTUDOS PRELIMINARES]
Maria doCarmodeAndradeNono and Geraldo Pereira Galvao Sep. 1987 36 p In PORTUGUESE; ENGLISH summary
(INPE-4375-RPE/554) Avail: NTIS HC A03/MF A01

A setup for a copper electroforming system is described. Starting with the acid copper sulfate bath, the more important parameters of the copper electroforming process are studied with the objective of achieving an adequate control and maintenance of the process. Author

N88-15865# Argonne National Lab., Ill.
EXPERIMENTAL METHOD FOR INVESTIGATING HELIUM EFFECTS IN IRRADIATED VANADIUM
D. L. Smith, H. Matsui, L. Greenwood, and B. Loomis Oct. 1987 18 p Presented at the 3rd International Conference on Fusion Reactor Materials, Karlsruhe, Fed. Republic of Germany, 4 Oct. 1987 Prepared in cooperation with Tohoku Univ., Sendai, Japan
(Contract W-31-109-eng-38)
(DE88-002891; CONF-871036-19) Avail: NTIS HC A03/MF A01

Analyses have been performed which indicate that an effective method for experimentally investigating helium effects in neutron irradiated vanadium base alloys can be developed. The experimental procedure involves only modest modifications to existing procedures currently used for irradiation testing of vanadium-base alloys in the FFTF reactor. Helium is generated in the vanadium alloy by decay of tritium which is either preinjected or generated within the test capsule. Calculations indicate that nearly constant He/dpa ratios of desired magnitude can be attained by proper selection of experimental parameters. The proposed method could have a major impact on the development of vanadium base alloys for fusion reactor applications. DOE

N88-15866# Argonne National Lab., Ill.
KINETICS AND MECHANISM OF THERMAL AGING EMBRITTLEMENT OF DUPLEX STAINLESS STEELS
H. M. Chung and O. K. Chopra Jun. 1987 32 p Presented at the 3rd International Symposium on Environmental Degradation of Materials in Nuclear Power Systems: Water Reactors, Traverse City, Mich., 30 Aug. 1987
(Contract W-31-109-eng-38)
(DE88-002987; CONF-870839-6) Avail: NTIS HC A03/MF A01

Microstructural characteristics of long-term-aged cast duplex stainless steel specimens from eight laboratory heats and an actual component from a commercial boiling water reactor have been investigated by scanning electron microscopy (SEM), transmission electron microscopy (TEM), small angle neutron scattering (SANS), and atom probe field ion microscopy (APFIM) techniques. Three precipitate phases, i.e., Cr-rich alpha prime and the Ni- and Si-rich

G phase, and gamma sub 2 austenite, have been identified in the ferrite matrix of the aged specimens. For CF-8 grade materials, M23C6 carbides were identified on the austenite-ferrite boundaries as well as in the ferrite matrix for aging at greater than or equal to 450 C. It has been shown that Si, C, and Mo contents are important factors that influence the kinetics of the G-phase precipitation. However, TEM and APFIM analyses indicate that the embrittlement for less than or equal to 400 C aging is primarily associated with Fe and Cr segregation in ferrite by spinodal decomposition. For extended aging, e.g., 6 to 8 years at 350 to 400 C, large platelike alpha prime formed by nucleation and growth form the structure produced by the spinodal decomposition. The Cr content appears to play an important role either to promote the platelike alpha prime (high Cr content) or to suppress the alpha prime in favor of gamma sub 2 precipitation (low Cr). Approximate TTT diagrams for the spinodal, alpha prime, G, gamma sub 2 and the in-ferrite M23C6 have been constructed for 250 to 450 C aging. Microstructural modifications associated with a 550 C reannealing and a subsequent toughness restoration are also discussed. It is shown that the toughness restoration is associated primarily with the dissolution of the Cr-rich region in ferrite. DOE

N88-15867# California Univ., Berkeley. Lawrence Berkeley Lab.
TIN COATINGS ON M2 STEEL PRODUCED BY PLASMA ASSISTED CHEMICAL VAPOR DEPOSITION
M. R. Hilton, G. J. Vandentop, M. Salmeron, and G. A. Somorjai 3 Sep. 1987 20 p Presented at the International Conference on Metallurgical Coatings, San Diego, Calif., 23 Mar. 1987
(Contract DE-AC03-76SF-00098)
(DE88-003189; LBL-23131; CONF-870388-15) Avail: NTIS HC A03/MF A01

TiN films were deposited onto M2 steel using plasma-assisted chemical vapor deposition. TiCl4, N2 and H2 were the reactant gases used at 1 torr. A plasma was essential for TiN formation at 500 C and below. At 500 C, a highly crystalline stoichiometric TiN coating was formed with a (200) surface orientation and having a columnar Zone 2 grain structure. At 400 C, a Zone T structure with an additional amorphous component was observed. Both types of films had good adherence with scratch adhesion critical loads comparable to values for sputtered TiN. The Zone 2 films failed by cracking and occasional chipping within the coating. The Zone T films failed by cracking in the coating and by chipping, within the coating and by the interface. AES depth profiling of thin films indicates that the interface was sharp and no accumulation of Cl is observed. AES and SEM suggest that distinct TiN islands or nuclei are present in the early stages of growth. The use of an organometallic source, titanium tetrakis (dimethylamide), resulted in the formation of carbonitride powders. DOE

N88-15868# California Univ., Berkeley. Lawrence Berkeley Lab.
Nb3Al FORMATION IN SPUTTER-DEPOSITED Nb/Al MUTLI-LAYER SAMPLES
Yoonsoon Im, P. E. Johnson, L. T. McKnelly, Jr., and J. W. Morris, Jr. Nov. 1987 21 p Presented at the American Institute of Metallurgical Engineers Annual Meeting: Light Metals Session, Denver, Colo., 22 Feb. 1987
(Contract DE-AC03-76SF-00098)
(DE88-003192; LBL-22836; CONF-870272-11) Avail: NTIS HC A03/MF A01

The critical current density of powder metallurgy processed wires is determined in part by the extent of the A15 phase formation in the vicinity of the Nb/Al interface. A series of multi-layered samples was made to simulate the reactions in the P/M wires. Transmission electron microscopy was used to study the reactions between the multi-layers. Results indicate that the reactions at the Nb/Al interface depend strongly on the Nb and Al layer thickness and distribution. No evidence of the metastable NbAl solid solution formation was found. It is concluded that the Nb2Al and the residual Nb present in the reacted P/M wires can be avoided if the Nb and Al layers are sufficiently thin and uniformly distributed with the proper stoichiometry. DOE

N88-15869# Drexel Univ., Philadelphia, Pa. Dept. of Materials Engineering.
SPRAY DEPOSITION: A FUNDAMENTAL STUDY OF DROPLET IMPINGEMENT, SPREADING AND CONSOLIDATION Annual Report, 1 Jul. 1986 - 30 Jun. 1987
D. Apelian, A. Lawley, G. Gillen, and P. Mathur 1 Sep. 1987 52 p
(Contract N00014-84-K-0472)
(AD-A186627; TR-3) Avail: NTIS HC A04/MF A01 CSCL 11F

Net or near net shape products can be manufactured by technologies involving solidification processing, metal forming, particle processing, and droplet consolidation. One example of droplet consolidation is spray deposition in the Osprey mode. In this process, a stream of liquid metal is atomized by an inert gas to form a spray of molten droplets; these are accelerated towards a substrate where they impinge and consolidate. Mathematical models have been developed to describe droplet-gas interactions in flight and droplet behavior on impact with the substrate. The models predict droplet velocity and temperature as a function of flight distance, the extent of droplet solidification on arrival at the substrate, and temperature distribution in the consolidated material during deposition. Measured values of droplet velocity, the progress of droplet solidification, and attendant temperature profiles after consolidation on the substrate substantiate the integrity of the models. This approach demonstrates the utility of modeling studies in order to establish quantitive guidelines for optimization of the process in terms of the evolution of microstructure in droplet consolidation. GRA

N88-16507# Joint Publications Research Service, Arlington, Va.
MODIFICATION OF PROPERTIES OF METALS BY HIGH-POWER ION BEAMS Abstract Only
A. D. Pogrebnyak, G. Ye. Remnev, S. A. Chistyakov, and A. Ye. Ligachev *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 48 Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedeniy: Fizika (Tomsk, USSR), v. 30, no. 1, Jan. 1987 p 52-65 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

For composite materials see *24 Composite Materials*.

N88-15870# China Scientific and Technical Univ., Beijing.
STUDY ON THE CORRELATION OF POLYSTYRENE (PS) FILM CRAZE TO ITS FRACTURE BEHAVIOUR BY TEM (TRANSMISSION ELECTRON MICROSCOPY)
X. Lu, C. Fan, and R. Qian 1986 10 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143343; ISTIC-TR-C-000053) Avail: NTIS HC E03/MF E01 CSCL 11B

The microstructure, deformation and failure processes of polystyrene (PS) film crazes were observed by transmission electron microscopy. It was discovered that the crossing of two crazes might affect their growing, and the structure at cross point was stable. The entire craze fibrillar network and the large orientation of breaking fibrils were found. It was recognized that the process in which the craze fibrils failed or the microcrack was initiated was very similar to the tearing cloth model proposed by the same authors for explaining the slow crack propagation in PMMA and that the crack tip craze in PS film obeyed the Dugdale model in contour. GRA

N88-15871# Shanghai Inst. of Machinery Mfg. Technology (China).
TIN ACTIVATED REACTIVE ION PLATING AND ITS APPLICATION

T. Yen, R. Zhang, and Y. Jiang 1986 10 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-144036; ISTIC-TR-C-000090) Avail: NTIS HC E03/MF E01 CSCL 13H

This discussion is concerned with the relations between the formation of TiN with high microhardness and the partial pressures of N2 and titanium vapor, and the effect of ion bombardment cleaning on the bonding force between the coating and the base. The paper also describes the effect of auxiliary anode in enhancing the ionization of nitrogen and titanium, and points out that there is an interlayer between the coating and the base when the workpiece is charged with a negative high potential. The application and results of this technology are listed. GRA

N88-15872*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HOT PISTON RING/CYLINDER LINER MATERIALS: SELECTION AND EVALUATION Final Report
Harold E. Sliney 1988 19 p Proposed for presentation at the 1988 International Congress and Exposition, Detroit, Mich., 29 Feb. - 4 Mar. 1988; sponsored by the Society of Automotive Engineers, Inc.
(Contract DE-AI01-85CE-50112)
(NASA-TM-100276; DOE/NASA/50112-73; E-3917; NAS 1.15:100276) Avail: NTIS HC A03/MF A01 CSCL 11B

In current designs of the automotive (kinematic) Stirling engine, the piston rings are made of a reinforced polymer and are located below the pistons because they cannot withstand the high temperatures in the upper cylinder area. Theoretically, efficiency could be improved if hot piston rings were located near the top of the pistons. Described is a program to select piston ring and cylinder coating materials to test this theory. Candidate materials were screened, then subjected to a pin or disk friction and wear test machine. Tests were performed in hydrogen at specimen temperatures up to 760 C to simulate environmental conditions in the region of the hot piston ring reversal. Based on the results of these tests, a cobalt based alloy, Stellite 6B, was chosen for the piston rings and PS200, which consists of a metal-bonded chromium carbide matrix with dispersed solid lubricants, was chosen as the cylinder coating. Tests of a modified engine and a baseline engine showed that the hot ring reduced specific fuel consumption by up to 7 percent for some operating conditions and averaged about 3 percent for all conditions evaluated. Related applications of high-temperature coatings for shaft seals and as back-up lubricants are also described. Author

N88-15873# Sandia National Labs., Albuquerque, N. Mex.
PROCESSING AND INTERFACIAL ANALYSIS OF GLASS-CERAMIC TO METAL SEALS
R. E. Loehman 1987 8 p Presented at the Symposium on Technology of Glass, Ceramic or Glass-Ceramic to Metal Sealing, Boston, Mass., 13 Dec. 1987
(Contract DE-AC04-76DP-00789)
(DE88-002999; SAND-87-2694C; CONF-871207-20) Avail: NTIS HC A02

Glass-ceramics are useful for metal-insulator seals because of their ease of processing and the wide range of thermal expansion coefficients (CTEs) that can be obtained. Using glass-ceramics to full advantage requires detailed understanding of crystallization mechanisms and of possible interfacial reactions between the metal and the glass-ceramic. Such an understanding was obtained for one family of LiO2-SiO2 glass-ceramics that were sealed to a wide variety of high CTE alloys. Sealing reactions that promote interfacial bonding may create reaction zones with different CTEs. The properties of those reaction zones can be measured so they can be taken into account when designing glass-ceramic to metal seals. DOE

N88-15874*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
NUMERICAL SOLUTION METHODS FOR VISCOELASTIC ORTHOTROPIC MATERIALS Technical Report, 15 Mar. - 1 Sep. 1987
K. C. Gramoll, D. A. Dillard, and H. F. Brinson Jan. 1988 59 p
(Contract NCC2-71)
(NASA-CR-182381; NAS 1.26:182381; VPI-E-88-1; CAS/ESM-88-1) Avail: NTIS HC A04/MF A01 CSCL 11B

Numerical solution methods for viscoelastic orthotropic materials, specifically fiber reinforced composite materials, are examined. The methods include classical lamination theory using time increments, direction solution of the Volterra Integral, Zienkiewicz's linear Prony series method, and a new method called Nonlinear Differential Equation Method (NDEM) which uses a nonlinear Prony series. The criteria used for comparison of the various methods include the stability of the solution technique, time step size stability, computer solution time length, and computer memory storage. The Volterra Integral allowed the implementation of higher order solution techniques but had difficulties solving singular and weakly singular compliance function. The Zienkiewicz solution technique, which requires the viscoelastic response to be modeled by a Prony series, works well for linear viscoelastic isotropic materials and small time steps. The new method, NDEM, uses a modified Prony series which allows nonlinear stress effects to be included and can be used with orthotropic nonlinear viscoelastic materials. The NDEM technique is shown to be accurate and stable for both linear and nonlinear conditions with minimal computer time. Author

N88-15875# Societe Nationale Industrielle Aerospatiale, Suresnes (France). Direction Centrale de la Qualite.
STUDY OF SELECTION CRITERIA FOR ADHESIVES USED IN AIRCRAFT STRUCTURE BONDING Final Report [RECHERCHE DE CRITERES DE SELECTION D'ADHESIFS EN VUE DU COLLAGE STRUCTURAL AERONAUTIQUE]
J. N. Dewas 14 Apr. 1987 115 p In FRENCH
(Contract DRET-84-34-440-00-470-75-01)
(ETN-88-91619; Test-Rept-DCQ/L-47-378/F) Avail: NTIS HC A06/MF A01

Modified epoxy structural adhesives used for aerospatial applications were investigated. The nonpolymerized state was studied using infrared absorption, liquid column chromatography, nuclear magnetic resonance, and thermomechanical tests. The polymerized state was characterized using torsion and tensile tests, creep tests, morphological studies and thermomechanical tests. The results show that the torsion tests are the most efficient, in combination with the chemical analysis, to furnish information on the structural characteristics of the polymer. ESA

N88-15876# Institut Franco-Allemand de Recherches, St. Louis (France).
FERROELECTRIC PROPERTIES AND IMPACT BEHAVIOR OF THE PVF2 POLYMER AND THE VF2/C2F3H POLARIZED COPOLYMERS [PROPRIETES FERROELECTRIQUES ET REPONSE SOUS CHOC DU POLYMERE PVF2 ET DES COPOLYMERES VF2/C2F3H POLARISES]
F. Bauer 21 Nov. 1986 14 p In FRENCH; ENGLISH and GERMAN summaries Presented at the Capteurs 86 Congress, Paris, France, 17-19 Jun. 1986
(Contract DRET-84-033)
(ISL-CO-245/86; ETN-88-91636) Avail: NTIS HC A03/MF A01

The ferroelectric characteristics of PVF2 and its copolymers, their behavior under dynamic compression, and the properties of PVF2 under a shock wave (application to shock wave sensors) are presented. The remanent polarization of PVF2 is measured to 10 micro Coublombs/sq cm. It is shown that the PVF2 could be used to produce wide band piezoelectric transducers (0 to 200 kbar). ESA

N88-15877# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Civil Engineering.
MECHANICAL PROPERTIES OF STEEL-TO-STEEL ADHESIVE BONDS Final Report
H. Nara, D. Gasparini, J. Andreani, and C. Boggs Nov. 1986 210 p Sponsored in part by FHA, Columbus, Ohio; Ohio Dept. of Transportation, Columbus

(PB88-111299; FHWA/OH-86/017) Avail: NTIS HC A10/MF A01 CSCL 11C

Static mechanical properties of steel-to-steel bonds are studied. The suitability of linear viscoelastic constitutive models for predicting stress-strain behavior is discussed. The static (cohesive) strength of bonds in various stress states is determined. Theories of adhesion are reviewed. Effects of diffusion of water on adhesives and on adhesion are discussed. Data from bond durability tests and from accelerated aging tests are reported. The correlation between water concentration and the presence of adhesion failures is discussed. GRA

N88-15878# Akron Univ., Ohio. Inst. of Polymer Science.
EFFECT OF PEEL ANGLE ON PEEL FORCE
Richard S. Miller Oct. 1987 24 p
(Contract N00014-85-K-0222)
(AD-A186117; TR-10) Avail: NTIS HC A03/MF A01 CSCL 11B

Measurements of peel force P per unit width are reported for samples of three adhesive tapes, adhering to two different substrates. In all cases, the work of detachment per unit area of bonded interface was found to depend upon the angle theta of detachment, increasing as theta increases. This effect is attributed to dissipation of energy in bending the tape away from the substrate at the line of detachment, to a greater degree as theta increases. Extrapolation to theta = 0 is suggested as a simple way of minimizing contributions to the observed work of detachment that arises from bending an imperfectly-elastic adhering layer as it is peeled away from a flat rigid substrate. But at small peel angles the tape tends to stretch appreciably. Peeling at 45 degrees is recommended to minimize both effects. GRA

N88-15879# Oak Ridge National Lab., Tenn.
THE MORPHOLOGY OF EMULSION POLYMERIZED LATEX PARTICLES
G. D. Wignall, V. R. Ramakrishnan, M. A. Linne, A. Klein, L. H. Sperling, M. P. Wai, R. A. Gelman, M. G. Fatica, R. H. Hoerl, and L. W. Fisher Nov. 1987 18 p Presented at the Workshop on Neutron Scattering, Los Alamos, N. Mex., 3 Nov. 1987 Prepared in cooperation with Lehigh Univ., Bethlehem, Pa., Hercules, Inc., Wilmington, Del. and Eastman Kodak Co., Rochester, N.Y.
(Contract DE-AC05-84OR-21400)
(DE88-002672; CONF-871190-1) Avail: NTIS HC A03/MF A01

Under monomer starved feed conditions, emulsion polymerization of perdeuterated methyl methacrylate and styrene in the presence of preformed polymethyl methacrylate latexes resulted in particles with a core-shell morphology, as determined by small-angle neutron scattering (SANS) analysis for a hollow sphere. The locus of polymerization of the added deuterated monomer is therefore at the particle surface. In similar measurements a statistical copolymer of styrene and methyl methacrylate was used as seed particles for further polymerization of trideuteromethyl methacrylate. The resulting polymer latex was again shown to have a core-shell morphological structure as determined by SANS. SANS experiments were also undertaken on polystyrene latexes polymerized by equilibrium swelling methods, with deuterated polymer forming the first or second step. The experiments covered a molecular weight range of 6 x 10 to the 4th power less than M less than 6 x 10 to the 6th power g/mol. For M greater than 10 to the 6th power the molecular weights are consistent with the experimental errors, indicating that the deuterium labeled molecules are randomly distributed in the latex. These results led to the finding that the polymer chains were constrained in the latex particles by factors of 2 to 4 from the relaxed coil dimensions. For M < 10^6 g/mol SANS gave zero angle scattering intensities much higher than expected on the basis of a random distribution of labeled molecules. Several models were examined, including the possible development of core-shell structures at lower molecular weights. DOE

N88-15880# California Univ., Berkeley. Lawrence Berkeley Lab.
FLUID MECHANICAL ISSUES IN POLYMER PROCESSING
M. M. Denn Oct. 1987 6 p Presented at the Symposium on Interdisciplinary Issues in Materials Processing and Manufacturing, Boston, Mass., 13 Dec. 1987
(Contract DE-AC03-76SF-00098)
(DE88-002767; LBL-24120; CONF-871233-1) Avail: NTIS HC A02/MF A01

Microstructure in polymers is developed during shaping operations which are carried out in the fluid state. Propagation of the large stresses caused by singularities associated with the flow of viscoelastic liquids near corners and lips is a limiting factor in the numerical solution of processing flows; the strength of the singularity is unknown. There is considerable evidence to indicate that the no-slip boundary condition is inappropriate in polymer processing flows, but the proper replacement has not been established. Other significant issues include flow instabilities and the analysis of the flow of anisotropic liquids. DOE

N88-15881# Massachusetts General Hospital, Boston. Radiology Dept.
THE USE OF NMR IMAGING TO MEASURE POROSITY AND BINDER DISTRIBUTIONS IN GREEN-STATE AND PARTIALLY SINTERED CERAMICS
J. L. Ackerman, L. Garrido, W. A. Ellingson, and J. D. Weyand Sep. 1987 34 p Presented at the Conference on Nondestructive Testing of High Performance Ceramics, Boston, Mass., 25 Aug. 1987 Prepared in cooperation with Argonne National Lab., Ill. and Aluminum Co. of America, Alcoa Center, Pa.
(Contract W-31-109-eng-38)
(DE88-003099; CONF-870856-3) Avail: NTIS HC A03/MF A01

Nonuniformities in porosity or binder distribution in green-state ceramic compacts can lead to failure in the final densified material. Nuclear magnetic resonance (NMR) imaging is a nondestructive characterization technique, most commonly used in medical diagnosis, which we have adapted for the production of tomographic images of porosity and of binder distributions. We measure open porosity by the imaging of a suitable filler fluid introduced into the part by vacuum impregnation. Our results on partially sintered bodies show rough correlations with predicted porosity distributions. Binders with a high content of plasticizer may be imaged directly. Binder distributions with a plasticizer weight percent typical of those used in cold-pressing and injection molding cannot be imaged with conventional clinical or animal research instrumentation and methods. We have been successful in imaging such binders directly. We present results illustrating our techniques in a series of green-state and partially sintered aluminas. DOE

N88-15882# Argonne National Lab., Ill.
STEADY-STATE DEFORMATION OF SOME LITHIUM CERAMICS
R. B. Poeppel, J. L. Routbort, M. C. Billone, D. S. Applegate, E. Buchmann, and B. Londschien May 1987 15 p Presented at the Symposium on Fabrication and Properties of Lithium Ceramics, Pittsburgh, Pa., 26 Apr. 1987
(Contract W-31-109-eng-38)
(DE88-003116; CONF-8704230-1) Avail: NTIS HC A03/MF A01

The stress-strain behavior of Li2O, LiAlO2 and Li2ZrO3 polycrystals, with densities varying from 0.70 to 0.95 of the theoretical, has been measured in constant-crosshead-speed compression tests at temperatures of 700 to 1000 C with strain rates ranging from about 10 to the -6 to 10 to the -4/sec. A steady-state stress, sigma(sub s), for which the work-hardening rate becomes zero, was achieved. These results, therefore, yield information equivalent to that obtained from creep experiments. Limited data on LiAlO2 and Li2ZrO3 were obtained. Nevertheless, under comparable conditions the lithium aluminate and zirconate were considerably stronger than the Li2O. This finding may be related to differences in crystal structure. It is, however, likely that in operation as a function breeder blanket material, the oxide will swell whereas the aluminate and the zirconate will crack. DOE

N88-15883# Los Alamos National Lab., N. Mex.
PROCESSING, FABRICATION, APPLICATIONS AND LIMITATIONS OF INHERENTLY CONDUCTING POLYMERS
M. Aldissi Nov. 1987 95 p
(Contract W-7405-eng-36)
(DE88-003210; LA-10686-MS) Avail: NTIS HC A05/MF A01

Electrically conducting polymers have many potential applications. Such polymers depend on a conjugated backbone that can be doped with highly reactive materials to increase conductivity, but this backbone is also the source of instability in these materials. The work described in this report concentrates on solving these instability problems, using various doping techniques to yield polymers more stable than polyacetylene, (CH)(sub x), the first extensively characterized covalent organic polymer. We describe several methods of synthesizing conjugated polymers and discuss ways of doping the conjugated backbone. The stability of pristine and doped polymers is examined in ambient atmosphere and under thermal treatment, and several stabilization techniques are discussed, including chemical doping, ion implantation, plastification, copolymerization, antioxidative treatments, surface protection, and the use of crown ethers. Although progress has been made, a fully stable, highly conductive polymer still awaits development. Various possible uses for such a polymer and the conditions for successful application are described, as are the relative advantages and disadvantages of currently available polymers. DOE

N88-15884*# National Aeronautics and Space Administration, Washington, D.C.
CORRELATION BETWEEN FLAMMABILITY AND HEAT OF COMBUSTION OF POLYMERS
Zbigniew Dobkowski Dec. 1987 12 p Transl. into ENGLISH from Wspolzalenznosc Palnosci i Ceipla Spalania Polimerow, Polimery Weilkoczasteczkowe (Poland), v. 22, no. 10, 1977 p 351-355 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original document was prepared by Inst. of Industrial Chemistry, Warsaw, Poland
(Contract NASw-4005)
(NASA-TT-20116; NAS 1.77:20116) Avail: NTIS HC A03/MF A01 CSCL 11B

A survey is made and a method given for calculating the flammability of polymers from the heat of combustion. Author

N88-15885*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPUTTERED SILVER FILMS TO IMPROVE CHROMIUM CARBIDE BASED SOLID LUBRICANT COATINGS FOR USE TO 900 C
Christopher DellaCorte, Harold E. Sliney, and Daniel L. Deadmore 1988 17 p Prepared for the Annual Meeting of the Society of Tribologists and Lubrication Engineers, Cleveland, Ohio, 8-12 May 1988
(NASA-TM-100783; E-3955; NAS 1.15:100783) Avail: NTIS HC A03/MF A01 CSCL 11H

Thin silver films, 250 to 3500 A thick, were sputtered onto PS200, a plasma sprayed, chromium carbide based solid lubricant coating, to reduce run-in wear and improve tribological properties. The coating contains bonded chromium carbide as the wear resistant base stock with silver and barium fluoride/calcium fluoride eutectic added as low and high temperature lubricants respectively. Potential applications for the PS200 coating are cylinder wall/piston ring lubrication for Stirling engines and foil bearing journal lubrication. In this preliminary program, the silver film overlay thickness was optimized based on tests using a pin-on-disk tribometer. The friction and wear studies were performed in a helium atmosphere at temperatures from 25 to 760 C with a sliding velocity of 2.7 m/s under a 4.9 N load. Films between 1000 and 1500 A provide the best lubrication of the counterface material. The films enrich the sliding surface with lubricant and reduce the initial abrasiveness of the as ground, plasma-sprayed coating surface, thus reducing wear. Author

N88-15886*# AiResearch Casting Co., Torrance, Calif.
IMPROVED SILICON NITRIDE FOR ADVANCED HEAT ENGINES Annual Technical Report, 26 Sep. 1984 - 30 Sep. 1985
H. C. Yeh, J. M. Wimmer, H. H. Huang, M. E. Rorabaugh, J. Schienle, and K. H. Styhr 15 Oct. 1985 149 p
(Contract NAS3-24385)
(NASA-CR-175006; NAS 1.26:175006; Rept-85-22592) Avail: NTIS HC A07/MF A01 CSCL 11B

The AiResearch Casting Company baseline silicon nitride (92 percent GTE SN-502 Si sub 3 N sub 4 plus 6 percent Y sub 2 O sub 3 plus 2 percent Al sub 2 O sub 3) was characterized with methods that included chemical analysis, oxygen content determination, electrophoresis, particle size distribution analysis, surface area determination, and analysis of the degree of agglomeration and maximum particle size of elutriated powder. Test bars were injection molded and processed through sintering at 0.68 MPa (100 psi) of nitrogen. The as-sintered test bars were evaluated by X-ray phase analysis, room and elevated temperature modulus of rupture strength, Weibull modulus, stress rupture, strength after oxidation, fracture origins, microstructure, and density from quantities of samples sufficiently large to generate statistically valid results. A series of small test matrices were conducted to study the effects and interactions of processing parameters which included raw materials, binder systems, binder removal cycles, injection molding temperatures, particle size distribution, sintering additives, and sintering cycle parameters. Author

N88-15887# Allied-Signal Corp., Morristown, N.J. Biosciences Lab.
SYNTHESIS OF HIGH MOLECULAR WEIGHT PEPTIDE POLYMERS AND COPOLYMERS CONTAINING L-DOPE RESIDUES Final Annual Report, Aug. 1986 - Jul. 1987
Jon I. Williams Jul. 1987 8 p
(Contract N00014-86-C-0484; RR0-4106)
(AD-A186462) Avail: NTIS HC A02/MF A01 CSCL 06A

The sea mussel M. edulis utilizes a polyphenolic protein in its adhesive plaque which contains tandem repeats of variants of a decapeptide sequence. We have chemically synthesized members of several families of glue peptides related to a consensus decapeptide sequence and have established methods for cleaving and purifying significant amounts of each. Chemical polymerization of model peptides using diphenylphosphorylazide activation has concurrently been studied in preparation for polymerization and lap shear adhesive strength tests for the glue peptides being synthesized. An evaluation of an alternative production method for polypeptides with repeating amino acid sequences has also begun using recombinant DNA techniques. Several expression vectors based on the regulatable lambda P sub L promoter have been developed. Gene cassettes coding for analogs to the polyphenolic protein or collagen have been designed and prepared, and have been or are being cloned for expression studies. Expression studies with a cloned collagen analog gene have revealed several potential drawbacks to high level microbial expression of genes with repeating amino acid sequences which are being addressed. GRA

N88-15888# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MECHANISM OF STEREO REGULATION DURING ANIONIC POLYMERIZATION OF POLAR MONOMERS
V. N. Krasulina, A. S. Khachaturov, N. V. Mikhaylova, and B. L. Yerusalimskiy 30 Oct. 1987 12 p Transl. into ENGLISH from Vysokomolekulyarnyye Soyedineniya. Seriya B: Kratkiye Soobshcheniya (USSR), v. 12, no. 4, Apr. 1970 p 303-306
(AD-A186530; FTD-ID(RS)T-0848-87) Avail: NTIS HC A03/MF A01 CSCL 07D

Formulation of the problem of the relative role of specific factors, which are basically capable of causing the corresponding effects, is justified in connection with the essential relationship of the microstructure of polymers formed due to the action of anionic initiators to the nature of the reaction medium. One of them is the change of overall polarity of the medium during the transition from one solvent to another, and the second is a formation of

complexes of active reaction centers of growth with components of the medium, which have electron donor properties. In this report we shall limit our examination to the particular but very interesting case, specifically the system of the metal alcyl-polar monomer-nonpolar solvent with the inclusion of data obtained in studying the microtactics of polymethylmethacrylic (PMMA), which is formed due to the action of lithium butyl with various ratios of monomer to solvent. The synthesized polymers were studied by infrared and NMR spectroscopy methods. GRA

N88-15889# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORETICAL BASES OF POLYMER PHOTODEGRADATION AND PHOTOOXIDATION
J. Rabek 15 Oct. 1987 34 p Transl. into ENGLISH from Polimery-Tworzywa Wieldczastechzkowe (Poland), v. 16, no. 6, 1971 p 257-266
(AD-A186533; FTD-ID(RS)T-0868-87) Avail: NTIS HC A03/MF A01 CSCL 07C

The photodegradation and photooxidation of polymers are interrelated processes which occur simultaneously during the photoaging of polymers in the air. Only under laboratory conditions can one distinguish photodegradation from photooxidation by conducting reactions in an oxygen-free atmosphere. Polymers synthesized on an industrial scale are contaminated with various low-molecular compounds derived from the technological process (initiators, inhibitors, moderators, solvents, etc.). In addition, when such processes are carried out in an atmosphere of air, numerous carbonyl, carboxyl, hydroxyl, etc. groups form along the polymer chain. It is quite difficult and sometimes downright impossible to eliminate these impurities. For this reason, an examination of the issue of polymer photoaging should be multilateral. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N88-15890# Etablissement Technique de Bourges (France).
CALCULATION EVALUATION OF THE BOUNDARY CONDITIONS OF AUTOINFLAMMATION OF PROPULSIVE CHARGES
M. Leveque Sep. 1986 39 p In FRENCH
(PB87-139044) Avail: NTIS HC E04/MF E01 CSCL 21I

Described is a calculation method which makes it possible to follow the thermal evolution of a propulsive charge under given conditions. It is then applied to explosives in cases, tanks or containers, and has allowed us to establish a scale as a function of the power generated by a propellant, applicable to the safe storage of munitions. GRA

N88-15891# Centre National d'Etudes Spatiales, Toulouse (France). Dept. Integration Lancement.
THE TV-SAT/TDF/TELE-X PYROTECHNICAL SYSTEM [PROJETS TV-SAT TDF TELE-X SYSTEME PYROTECHNIQUE]
J. P. Bouloumie 10 Sep. 1987 74 p In FRENCH
(CNES-87/CT/DRT/TVE/IL/358; ETN-88-91615) Avail: NTIS HC A04/MF A01

A summary of the available documentation on the pyrotechnical system common to the TV-SAT, TDF and TELE-X projects is presented. It is made from technical specifications and definition studies concerning the overall pyrotechnical functions of the vehicle. It includes the separation system from the Ariane launcher, the unified propulsion system, the solar generator deployement system, and the deblocking of antennas and pointing mechanisms. ESA

N88-15892# Southwest Research Inst., San Antonio, Tex.
VAPOR GENERATION OF FUELS Final Report, Apr. - Jun. 1987
L. R. Smith Aug. 1987 79 p
(Contract EPA-68-03-3353)
(PB88-109897; EPA-460/3-87-001) Avail: NTIS HC A05/MF A01 CSCL 21D

The data from two previous work assignments conducted at the Southwest Research Institute for the Environmental Protection Agency were combined, and the resulting data set analyzed. When possible, the combined results were generalized in order to draw conclusions. In the first work assignment, vapors from twelve gasolines and gasoline/alcohol blends were analyzed for butanes, total hydrocarbons, methanol, and appropriate cosolvent alcohols. The analyses were conducted in duplicate for each fuel at FTP diurnal SHED temperatures (60 to 84 F) and at typical hot soak temperatures (160 + or - 10 F). The fuels were prepared with different levels of aromatic content and Reid Vapor Pressure. The second work assignment study involved generating vapors from seven gasoline and gasoline/alcohol blends during simulated diurnal tests conditions (15 to 40, 35 to 60 and 60 to 84 F). These vapors were analyzed for total hydrocarbons, alcohols, and individual hydrocarbons up to and including C6. The Reid Vapor Pressure of the seven fuels varied from 9.12 to 15.0 psi. GRA

N88-15893# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.
FUEL NITROGEN CONVERSION IN A SUPERCHARGED SPARK IGNITION ENGINE
J. W. Hodgson and J. C. Denny Oct. 1987 133 p
(Contract DE-AC05-84OR-21400)
(DE88-003739; ORNL/Sub-85-97367/1) Avail: NTIS HC A07/MF A01

The prospect of future fuels' containing more nitrogen than existing fuels, coupled with the possibility that automobile manufacturers may resort to increased use of supercharging, has motivated this study. The objective is to determine whether high levels of fuel-bound nitrogen lead to increased emissions of nitric oxide in a supercharged engine. The study was conducted in three phases. Phase 1 involved determining the nitric oxide (NO) emissions for various values of compression ratio, intake manifold pressure, air-fuel ratio, and fuel-nitrogen level. Phase 2 involved determining the effect of the base fuel aromatic content on the NO emissions and Phase 3 tested Solvent Refined Coal (SRC), a synthetic gasoline containing no nitrogen. For each phase, the engine was run at 1800 rpm and MBT (Minimum for Best Torque) spark timing. The fuel-nitrogen levels were created by doping the base fuel with pyridine. Results are presented in terms of the mass flow rate of nitrogen in the NO per mass flux of fuel (MNOMF) versus equivalence ratio. The fraction of the fuel nitrogen converted to nitric oxide was also calculated for Phase 1 data. In evaluating the results, it was found that the fuel nitrogen level had less effect on the NO emissions than the effects one would expect from routine variations in inlet air humidity. In Phase 2, it was found that the aromatic content of the base fuel had no measured effect on NO emissions. In Phase 3, the SRC fuel gave values of NO that were similar to those obtained from the other fuels tested. DOE

N88-15894# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A CONTINUOUS OXIDIZER REGRESSION MODEL FOR THE COMBUSTION OF COMPOSITE SOLID PROPELLANTS M.S. Thesis
Joseph J. Cor 1986 115 p
(AD-A186742; AFIT/CI/NR-87-69T) Avail: NTIS HC A06/MF A01 CSCL 21I

Over the past several decades, there has been a considerable effort to model the process occurring during the combustion of composite solid propellents. Accurate models able to predict the burning rate characteristics of solid propellents would be very valuable, as they would facilitate the design of solid rocket fuels by reducing the need for laboratory testing of different solid mixtures

until a mixture with the right ballistic properties is found. Using a reliable analytical model, a propellent designer could, in theory, simply input key properties of a possible propellent formulation into the model, and the model would provide an accurate prediction of what the burning rate characteristics for the mixture would be. Earlier attempts at modeling the steady-state burning of composite solid propellents are reviewed, with an emphasis placed on the Beckstead, Derr, and Price (BDP) and Petite Ensemble Model (PEM). The Continuous Oxidizer Regression (COR) model is then described, which is a modification to the PEM model. The COR model's predictions for burning rate and pressure exponent are then compared to those of an actual solid composite propellent. The model predicts the general trends found in actual experimental data, but the model's output is found to be highly sensitive to the assumptions regarding surface geometry and flame formation, which are as yet not clearly known. GRA

N88-15932*# General Dynamics Corp., San Diego, Calif. Space Systems Div.
LARGE CAPACITY CRYOPROPELLANT ORBITAL STORAGE FACILITY
J. R. Schuster *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 151-174 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 21I

N88-15940*# Washington Univ., St. Louis, Mo.
COMPUTATIONAL PREDICTION OF PROPELLANT REORIENTATION
John I. Hochstein *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 317-344 (For primary document see N88-15924 08-34)
(Grant NAG3-578)
Avail: NTIS HC A17/MF A01 CSCL 21I

29 MATERIALS PROCESSING

Includes space-based development of products and processes for commercial applications.
For biological materials see *55 Space Biology.*

N88-16260# Swedish Space Corp., Solna.
PRELIMINARY MATERIAL SCIENCE EXPERIMENT ROCKET (MASER) 1 RESULTS AND THE EVOLUTION OF THE MASER PROGRAM
J. Zaar, L. Bjoern, and R. Joensson *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 359-361 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

N88-16261# Saab-Space A.B., Linkoeping (Sweden).
FLIGHT RESULTS OF THE ESA EXPERIMENT MODULES IN MATERIALS SCIENCE EXPERIMENT ROCKET (MASER) 1
H. Grunditz *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 363-367 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

N88-16277# Saab-Scania, Goteberg (Sweden).
SOUNDING ROCKETS/MICROGRAVITY PRODUCTS AND SERVICE
A. Persson *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 455-459 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

N88-15895*# Martin Marietta Aerospace, Denver, Colo. Space Systems.
SERVICER SYSTEM DEMONSTRATION PLAN AND CAPABILITY DEVELOPMENT Final Technical Report
Dec. 1987 250 p
(Contract NAS8-35625)
(NASA-CR-179246; NAS 1.26:179246; MCR-87-1352; DPD-650-DR-5) Avail: NTIS HC A11/MF A01 CSCL 13B

An orbital maneuvering vehicle (OMV) front end kit is defined which is capable of performing in-situ fluid resupply and modular maintenance of free flying spacecraft based on the integrated orbital servicing system (IOSS) concept. The compatibility of the IOSS to perform gas and fluid umbilical connect and disconnect functions utilizing connect systems currently available or in development is addressed. A series of tasks involving on-orbit servicing and the engineering test unit (ETU) of the on-orbit service were studied. The objective is the advancement of orbital servicing by expanding the Spacecraft Servicing Demonstration Plan (SSDP) to include detail demonstration planning using the Multimission Modular Spacecraft (MMS) and upgrading the ETU control. B.G.

N88-15896# California Univ., Berkeley. Lawrence Berkeley Lab.
USE OF A GENERAL CONTROL SIMULATION PROGRAM TO EVALUATE HVAC CONTROL STABILITY
Xinbang Zhang and M. L. Warren Aug. 1987 31 p Presented at the ASHRAE Winter Meeting, Dallas, Tex., 30 Jan. 1988 Prepared in cooperation with Chinese Academy of Space Technology, Beijing
(Contract DE-AC03-76SF-00098)
(DE88-000476; LBL-23179; CONF-880128-1) Avail: NTIS HC A03/MF A01

A general process engineering simulation program for a microcomputer is used to evaluate the response of a cooling system to changes in load, set point, and controller tuning parameters to better understand the control stability of a supply air cooling system used in the Mobile Windows Thermal Test (MoWiTT) Facility. A detailed system model is built out of standard components and is used to plot the steady state performance under different operating conditions. The response of the cooling coil output depends strongly on the transport delays. For a system with a linear control valve, the process gain of the cooling coil increases rapidly as the valve flow fraction decreases. A system which is stable at mid-range is shown to become marginally unstable at the low end of the control range. The application of both an equal percentage valve and reheat are shown to improve the control response of the system under low cooling load conditions. DOE

N88-15897# Vibration Inst., Clarendon Hills, Ill.
THE SHOCK AND VIBRATION DIGEST, VOLUME 20, NO. 1 Monthly Report
Judith Nagle-Eshleman, ed. Jan. 1988 76 p
Avail: NTIS HC A05/MF A01

Articles on rotor dynamic behavior of centrifugal pumps and modal analysis using frequency response measurement data are presented. Additional information presented includes book reviews, 38 pages of abstracts from the current shock and vibration literature (indexed by author, periodical, and subject category), and a calendar of events. For individual titles, see N88-15898 through N88-15899.

N88-15898# Byron Jackson Pumps, Etten-Leur (Netherlands).
ROTOR DYNAMIC BEHAVIOR OF CENTRIFUGAL PUMPS c37
J. J. Verhoeven and S. Gopalakrishnan (Byron Jackson Pumps, Long Beach, Calif.) *In* Vibration Inst., The Shock and Vibration Digest, Volume 20, No. 1 Jan. 1988 p 3-12 (For primary document see N88-15897 08-31)
Avail: NTIS HC A05/MF A01

Until recently, the rotor dynamic behavior of centrifugal pumps has been investigated by evaluating critical speed and the effects of close-clearance running fits. It is now increasingly recognized that a better criterion for assuring dynamic reliability is that the rotor response be stable and sufficiently damped. This paper reviews the available methods for and state of the art in effective prediction of the response of pump rotors. Author

N88-15899# Institutul Politehnic din Bucharest, (Rumania). Catedra de Rezistenta Materialelor.
MODAL ANALYSIS USING FREQUENCY RESPONSE MEASUREMENT DATA **c39**
M. Rades *In* Vibration Inst., The Shock and Vibration Digest, Volume 20, No. 1 Jan. 1988 p 13-21 (For primary document see N88-15897 08-31)
Avail: NTIS HC A05/MF A01

Some recent advances in frequency response-based structural testing are reviewed. Topics include development of new excitation techniques, procedures for improved spectral estimation and for computation of frequency response functions (FRF), and more effective parameter extraction methods. Emphasis is on testing methodology, possible sources of errors and ways to circumvent them and the theoretical background of estimation algorithms rather than on specific applications. Author

N88-15900# Institut National des Sciences Appliquees de Lyon, Villeurbanne (France). Lab. de Mecanique des Solides.
CONTRIBUTION TO THE STUDY OF WRINKLING IN METAL STAMPING Ph.D. Thesis [CONTRIBUTION A LETUDE DU PLISSEMENT EN EMBOUTISSA GE]
Salah Ellagoune 1987 145 p In FRENCH; ENGLISH abstract (ISAL-IDI1-87-08; ETN-88-91627) Avail: NTIS HC A07/MF A01

Experimental results obtained by a Moire fringe pattern method applied to eight kinds of sheet ranging from classical deep drawing steel to high strength steel are described. The kinematics of wrinkle development is recorded for each sample of metal. A computer solution of the Yoshida buckling test is presented. It is based on the finite element method and produces a complete parameter investigation. A large displacement formulation with shell elements shows that wrinkling is mainly sheet thickness dependent, yield stress dependent, and anisotropic rate dependent. ESA

N88-15901# Centro Informazioni Studi Esperienze, Milan (Italy).
INNOVATING SYSTEMS AND TECHNIQUES FOR THE DIAGNOSIS OF MATERIALS AND INDUSTRIAL PLANTS [TECNICHE E SISTEMI INNOVATIVI NELLA DIAGNOSTICA DEI MATERIALI E DEGLI IMPIANTI INDUSTRIALI]
S. Ghia, M. Certo, C. DeMichelis, M. Famiglietti, and F. Tonolini 1987 30 p In ITALIAN Presented at the 12th Congresso Nazionale Al MAN: Manutenzione e Qualita, Milan, Italy, 3-4 Jun. 1987
(CISE-3856; ETN-88-91647) Avail: NTIS HC A03/MF A01

The design of nondestructive continuous computerized monitoring systems applied to industrial plant maintenance and control is described. The example of a steam turbogenerator power plant monitoring system is detailed. The results show that such an integrated control and diagnosis system is reliable and accurate. ESA

N88-15902# Connecticut Univ., Storrs.
IDENTIFICATION AND FEEDBACK CONTROL OF MACHINE TOOL VIBRATIONS Final Report
N. Olgac [1987] 55 p
(Grant NSF MEA-83-00235)
(PB88-109715; NSF/ENG-87018) Avail: NTIS HC A04/MF A01 CSCL 20E

The general metal cutting mechanism is studied in the program by: (1) analytical modeling and analysis of the parametric influences on the model; and (2) numerical representation of the vibrations based on the data retrieved during the test cuts. The basic objectives of the study are: (1) to give the part programmer an extra insight for choosing the control parameters (depth of cut, feed rate, etc.); and (2) to identify and alleviate the vibratory conditions in real time applications. GRA

N88-15944*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GODDARD SPACE FLIGHT CENTER MECHANICAL COOLER PROGRAM
Stephen H. Castles *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 377-385 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 13B

N88-15945*# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
AIR FORCE CRYOCOOLER DEVELOPMENT FOR SPACECRAFT
William L. Haskin *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 387-388 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 13B

32 COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Space Communications, Spacecraft Communications, Command and Tracking.* For search and rescue see *03 Air Transportation and Safety,* and *16 Space Transportation.*

N88-15903# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
RADAR ECHO SIGNATURES VERSUS RELATIVE PRECIPITATION M.S. Thesis
Terry A. Huber 1987 39 p
(AD-A186162; AFIT/CI/NR-87-114T) Avail: NTIS HC A03/MF A01 CSCL 17I

The objective of this study is to show the relationship between cell-echo signatures and precipitation characteristics, and to support the hypothesis that, during the lifespan of any particular isolated convective cell, the relative rainfall rate, as determined by radar for a given volume scan and averaged over horizontal area of radar echo, is related to characteristics of echo-profiles of average reflectivity (dBz) and horizontal area, as defined by the 10-dBz contour. The data used were collected during the Texas HIPLEX (High Plains Cooperative Program) field experiments of 1979. Four isolated cases, two rainshowers and two thundershowers, were selected for study. Profiles from volume scans taken 10 minutes before, during, and 10 minutes after the maximum radar-determined rainfall rate, averaged over horizontal area of the echo for each use, were examined for signatures relative to the time of occurrence of this maximum average. The following tentative conclusions were reached based on the small sample. GRA

N88-15904# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE SINGLE PARTICLE AND COLLECTIVE DESCRIPTIONS OF THE ANOMALOUS DOPPLER RESONANCE AND THE ROLE OF ION DYNAMICS
R. O. Dendy, C. N. Lashmore-Davies (United Kingdom Atomic Energy Authority, Culham, England), and A. Montes Sep. 1987 20 p Submitted for publication Sponsored by Conselho Nacional de Desenvolvimento Cientifico e Tecnologico, Brazil
(INPE-4390-PRE/1210; CLM-P-766) Avail: NTIS HC A03/MF A01

The power bar j times bar E* dissipated by electrostatic waves interacting with a non-Maxwellian electron velocity distribution is considered. Its component terms illustrate the similarities and

differences between collective and single particle treatments of the anomalous Doppler resonance. Examination of the large-k region of wavenumber space (in constrast to the well known small-k region) shows that ion dynamics are important in stabilizing plasmas for which the electron velocity distribution considered alone is destabilizing. The sensitivity of theoretical descriptions to the choice of representation of the superthermal electron tail is examined analytically and numerically. Author

N88-15905# Research Inst. of National Defence, Linkoeping (Sweden).
AN EVALUATION OF EQUIVALENT MODELS FOR DESIGN OF RECTANGULAR MICROSTRIP ANTENNAS
Jan Svedin Jun. 1987 35 p In SWEDISH; ENGLISH summary
(FOA-C-30451-3.2; ISSN-0347-3708; ETN-88-91403) Avail: NTIS HC A03/MF A01; Research Institute of National Defence, Stockholm, Sweden KR 50

Simple models for rectangular microstrip antennas are described. The discontinuities in microstrip width are represented in terms of equivalent reactances and radiation conductances. The reactances were calculated by means of quasi-static methods. A number of linearly fed broadside antenna arrays, of lesser than 10 elements, were constructed, and agreement between theory and experiment is good. The influence of the equivalent inductances is small at 5 GHz. ESA

N88-15906# ANT Nachrichtentechnik, Backnang (West Germany). Space Communications Systems Div.
MBA PAYLOAD TESTING BY COMPACT ANTENNA TEST RANGE (CATR) Final Report
H. Wollenhaupt, H. P. Petry, and F. Intoppa Paris, France ESA Oct. 1986 165 p
(Contract ESTEC-6569/85)
(ESA-CR(P)-2473; ETN-88-91421) Avail: NTIS HC A08/MF A01

Large and compact antenna test range (FFTR, CATR) ability to evaluate parabolic antennas mounted on payloads was compared, using the Copernicus satellite. The handling requirements give a collection of facilities for CATR payload testing to ensure a high standard of environmental conditions and quality control during qualification and flight acceptance testing. Measurement of antenna boresight describes an alignment procedure for the electrical axis of the payload antennas, whereas the optical alignment test procedure precisely defines the position of the payload antennas within the satellite coordinate system. The radiation pattern test procedure describes the electrical qualification tests at equipment level on a satellite antenna system. These test procedures are applied at FFTR and can be adapted to CATR. Error analysis identifies and qualifies possible error sources within a CATR based on experience with an FFTR. As far as the FFTR procedures are applicable to a CATR, error identification is rather simple and error analysis can be evaluated using CATR specification data. ESA

N88-15907# Christiaan Huygenslaboratory, Noordwijk (Netherlands).
THE ESTEC MINI COMPACT ANTENNA TEST RANGE Final Report
Paris, France ESA Apr. 1987 33 p
(Contract ESTEC-6178/85-NL-GM)
(ESA-CR(P)-2475; ETN-88-91422) Avail: NTIS HC A03/MF A01

The ESTEC Mini Compact Antenna Test Range (Mini CATR) facility makes it possible to test full size antennas (up to 1.5 m) indoors in a relatively small space. A dual reflector system produces an incident plane wave so that the far field results are obtained in a relatively short distance. The operation of the Mini CATR is based on the characteristics of two parabolic reflectors. Since the operation of the reflectors is based on physical optics, it is quite independent of frequency. The RF energy from an antenna feed is collimated into a plane wave by the dual reflector system. To achieve the desired plane wave, the test room is lined with microwave absorber. The chamber is also RF-shielded to prevent influence from outside sources. The Mini CATR may be used for measurements of antenna patterns, gain, directivity, polarization, phase, boresight, radar cross section, as well as measurement of small payload performances like EIRP, G/T, and interference between beams. ESA

N88-15908# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Operations Research and System Theory.
THROUGHPUT ANALYSIS OF A FLOW-CONTOURED COMMUNICATION NETWORK WITH BUFFER SPACE LIMITATIONS
J. L. vandenBerg and O. J. Boxma Jan. 1987 19 p Submitted for publication
(CWI-OS-R8702; B8711094; ETN-88-91581) Copyright Avail: NTIS HC A03/MF A01

Traffic flow in a virtual circuit of a computer communication network with window flow control is studied. Due to finite buffer capacity, overflow of data packets is possible. Lost packets must be retransmitted. To maintain the original order of the packets, subsequently sent packets must also be retransmitted, causing a deterioration of throughput. An approximation method, based on a queueing network model, is developed to analyze the throughput behavior. This method leads to exact results for the single-hop network. For the multihop circuit, it yields very accurate approximations, as is illustrated by simulation. ESA

N88-15909# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Operations Research and System Theory.
WAITING TIMES IN DISCRETE-TIME CYCLIC-SERVICE SYSTEMS
O. J. Boxma and W. P. Groenendijk Mar. 1987 16 p Submitted for publication
(CWI-OS-R8707; B8711099; ETN-88-91585) Copyright Avail: NTIS HC A03/MF A01

Single-server, multiqueue systems with cyclic service in discrete time are considered. Nonzero switchover times between consecutive queues are assumed; the service strategies at the various queues may differ. A decomposition for the amount of work in such systems is obtained, leading to an exact expression for a weighted sum of the mean waiting times at the various queues. ESA

N88-15910*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUMERICAL ARC SEGMENTATION ALGORITHM FOR A RADIO CONFERENCE-NASARC (VERSION 2.0) TECHNICAL MANUAL
Wayne A. Whyte, Jr., Ann O. Heyward, Denise S. Ponchak, Rodney L. Spence, and John E. Zuzek 16 Oct. 1987 116 p
(NASA-TM-100160; E-3722; NAS 1.15:100160) Avail: NTIS HC A06/MF A01 CSCL 17B

The information contained in the NASARC (Version 2.0) Technical Manual (NASA TM-100160) and NASARC (Version 2.0) User's Manual (NASA TM-100161) relates to the state of NASARC software development through October 16, 1987. The Technical Manual describes the Numerical Arc Segmentation Algorithm for a Radio Conference (NASARC) concept and the algorithms used to implement the concept. The User's Manual provides information on computer system considerations, installation instructions, description of input files, and program operating instructions. Significant revisions have been incorporated in the Version 2.0 software. These revisions have enhanced the modeling capabilities of the NASARC procedure while greatly reducing the computer run time and memory requirements. Array dimensions within the software have been structured to fit within the currently available 6-megabyte memory capacity of the International Frequency Registration Board (IFRB) computer facility. A piecewise approach to predetermined arc generation in NASARC (Version 2.0) allows worldwide scenarios to be accommodated within these memory constraints while at the same time effecting an overall reduction in computer run time. Author

N88-15911# National Telecommunications and Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
SUMMARY RECORD OF PRESENTATIONS TO THE FEDERAL TELECOMMUNICATION STANDARDS COMMITTEE/FIBER OPTICS TASK GROUP
A. G. Hanson Mar. 1987 150 p Sponsored by National Communications System, Arlington, Va.
(PB88-110853; NTIA-SP-87-20; NCS-TIB-87-6; PB87-152138)
Avail: NTIS HC A07/MF A01 CSCL 17B

The learning experience of a group of Federal-agency planners who face upgrading or augmenting existing on-premises communication systems and building wiring is documented. In July 1984, an inter..gency Fiber Optics Task Group was formed under the aegis of the Federal Telecommunication Standards Committee to study on-premises distribution systems, with emphasis on optical fiber implementation, sharing mutual problems and potential solutions for them. Chronological summary records of technical content of 11 Task Group meetings through September 1986 are summarized. Also condensed are the engineering presentations to the Task Group by industry on applicable state-of-the-art technology, including local area networks, private automatic branch exchanges, building wiring architecture, and optic fiber systems and components. GRA

N88-15912# Naval Ocean Systems Center, San Diego, Calif.
A RAYTRACE METHOD FOR A LATERALLY HETEROGENEOUS ENVIRONMENT Final Technical Report, Oct. 1986 - Apr. 1987
W. L. Patterson Jul. 1987 62 p
(AD-A186525; NOSC/TD-1180) Avail: NTIS HC A04/MF A01 CSCL 20N

The objective is to provide environmental support to system designers and field commanders to accurately forecast pertinent conditions and to make real time assessment tactical conditions. A raytrace technique has been developed to show the wave front path as it propagates through the laterally heterogenous medium where the index of refraction is allowed to vary both vertically and horizontally. This effort is specially geared toward future Navy systems that are presently in the planning stage or under development. GRA

N88-15913# Naval Ocean Systems Center, San Diego, Calif.
A SIMULTANEOUS M-ary CHANNEL HYPOTHESIS TEST WITH LEAST-MEAN-SQUARE SIGNAL AMPLITUDE ESTIMATION Interim Technical Report, Jan. - Jun. 1987
I. S. Reed (University of Southern California, Los Angeles.) and L. B. Stotts Aug. 1987 31 p
(AD-A186526; NOSC/TR-1183) Avail: NTIS HC A03/MF A01 CSCL 20N

This paper presents a new strategy for detecting and estimating multiple linearly independent signals immersed in additive random noise. This new approach is a Maximum Log-likelihood Ratio Test (MLRT) and determines the presence of one or more signals through a single filter operating on a received input data vector. In addition, it performs a signal-amplitude estimation when a positive response occurs. This test is a UNiformly Most Powerful Invariant Test and reduces the computationally intensive work to only those situations where important data exists. The estimation technique determines the signal amplitude of all possible input signals in a least-mean-square sense with a variance inversely proportional to the inherent signal-to-noise ratio of each linearly independent library waveform. Computer simulations verify the theory and demonstrate near-optimum performance of the MLRT for small signal libraries. The MLRT is close to optimum for larger signal sets, and is clearly optimum for complex multiwaveform signals. ratio test(MLRT), and Signal-to-noise ratio. GRA

N88-16068# Joint Publications Research Service, Arlington, Va.
ELECTROSTATIC VLF EMISSION DETERMINED FROM ROCKET AND SATELLITE EXPERIMENTS Abstract Only
N. I. Izhovkina and S. A. Pulinets *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 57 Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow, USSR), v. 27, no. 2, Mar. - Apr. 1987 p 270-273 Original language document was announced in IAA as A87-42016 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16079# Joint Publications Research Service, Arlington, Va.
FLUCTUATIONS IN FREQUENCY OF COHERENT RADIO SIGNALS IN SOLAR PLASMA ACCORDING TO VENERA-15 AND VENERA-16 DATA Abstract Only
N. A. Savich, S. L. Azarkh, A. S. Vyshlov, A. L. Gavrik, N. V. Laptev, and A. S. Nabatov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 68 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 243-250 Original language document was announced in IAA as A87-41740 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16168# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
INVERSION OF SIMULATED SATELLITE SIGNALS [INVERSION VON SIMULIERTEN SATELLITENSIGNALEN]
Martina Kaestner *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 148-156 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16173# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
A BACKSCATTER LIDAR PROPOSED FOR THE SECOND GERMAN SPACELAB MISSION [EIN RUECKSTREULIDAR-VORGESCHLAGEN FUER DIE ZWEITE DEUTSCHE SPACELAB-MISSION]
H. Quenzel *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 181-188 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16374*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REQUIREMENTS AND OPTIONS FOR COMMUNICATIONS SERVICES IN SUPPORT OF THE SYSTEMS AUTONOMY DEMONSTRATION PROJECT Abstract Only
Richard M. Brown and Robert Yee *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 83 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 17B

N88-16503# Joint Publications Research Service, Arlington, Va.
INTERACTION OF ACOUSTIC AND ELECTROMAGNETIC WAVES INVOLVED IN ANOMALOUS SKIN EFFECT Abstract Only
A. P. Kopasov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 43 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 91, no. 6(12), Dec. 1986 p 2140-2149 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N88-15914# Illinois Univ., Urbana. Coll. of Education.
EXTRACTION OF MOS VLSI (VERY-LARGE-SCALE-INTEGRATED) CIRCUIT MODELS INCLUDING CRITICAL INTERCONNECT PARASITICS Ph.D. Thesis
Shun-Lin Su Sep. 1987 165 p
(Contract N00014-84-C-0149)
(AD-A185847; UILU-ENG-87-2254) Avail: NTIS HC A08/MF A01 CSCL 09A

As the feature sizes of Very-Large-Scale-Integrated (VLSI) circuits continue to decrease, the timing performance of a design cannot be estimated accurately without introducing the signal delay due to interconnect parasitics. Modeling interconnect parasitics directly from a circuit layout is therefore emphasized. In this research, two programs, FEMRC and HPEX, have been developed to investigate the following areas: (1) interconnect modeling, (2) hierarchical parasitic circuit extraction, and (3) collapsing technique for interconnects. The FEMRC is a two-dimensional, finite-element program which computes the resistance or the capacitance from the user-specified geometry. Since the equation formulation for FEMRC is based on a finite-element method, there is no shape restrictions on dielectric interfaces or conductor geometries. In resistance calculation, a quasi-three-dimensional effect of contact resistance is also taken into account. The program HPEX is a hierarchical parasitic circuit extractor which takes the CIF layout description as an input and generates a SPICE input with different details of interconnect parasitics. In this extractor, analytical formulas fitted from numerical data are used to model interconnect parasitics of VLSI circuits in order to compromise between the accuracy and the computation time. Simulations show that by carefully fitting data analytical formulas can be very accurate, especially when the interconnect region is fairly regular. GRA

N88-15915# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
OBSERVATIONS OF AN ION ACOUSTIC OSCILLATION NEAR A PULSED SHEATH
N. St. J. Braithwaite, J. E. Allen (Oxford Univ., England), and J. L. Ferreira Sep. 1987 6 p Presented at the International Conference on Plasma Physics, Lausanne, Switzerland, 1984 Submitted for publication
(INPE-4386-PRE/1206) Avail: NTIS HC A02/MF A01

Experimental observation and modelling of the density rarefaction and subsequent compression associated with a single negative voltage pulse on a spherical electrode are described. Close agreement between the theoretical model and the observations was found in regards to the progress of the rarefaction front with time. The sheath edge is identified as the source of the perturbations. Author

N88-15916# Plessey Three-Five Group Ltd., Towcester (England).
GaAs MMIC YIELD EVALUATION Final Report
R. F. B. Conlon, M. W. Geen, B. J. Buck, J. A. Jenkins, and R. W. W. Charlton Paris, France ESA Apr. 1987 165 p Prepared in cooperation with Plessey Research (Caswell) Ltd., Towcester (England)
(Contract ESTEC-6461/85-NL-PB-(SC))
(ESA-CR(P)-2470; ETN-88-91156) Copyright Avail: NTIS HC A08/MF A01

The design and layout of a two-stage X-band amplifier is described. Six wafers from nine wafer starts were successfully processed. The average overall yield of dc and visually acceptable circuits from the wafers is 39 percent. The yield of passive circuit elements is virtually 100 percent after excluding the edge circuits. Extremely tight spreads of FET S-parameters are demonstrated up to 14 GHz, confirming the degree of RF uniformity achieved over the full wafer area and over a wide range of I (DSS). A sample of 15 circuits was randomly selected from each wafer and measured against the ESA requirement. For each wafer excellent RF uniformity is demonstrated for all parameters. At the 95 percent confidence level, the estimated average yield for gain, gain ripple, noise figure, 1 dB gain compression, and C/I is 39 percent, i.e., all circuits meeting dc and visual requirements meet RF requirements. The estimated average yield for return loss is 3 percent and 12 percent for input and output return loss, respectively. ESA

N88-15917# Research Inst. of National Defence, Linkoeping (Sweden).
ELECTRIC DESIGN RULES RELATED TO LATCH-UP AND RADIATION
Bertil Sigfridsson and Maria Cornefjord Jan. 1987 30 p In SWEDISH; ENGLISH summary Sponsored by the Swedish Material Administration of Armed Forces (Air Material Dept.)
(FOA-E-30006-3.1; ISSN-0281-9937; ETN-88-91402) Avail: NTIS HC A03/MF A01; Research Institute of National Defence, Stockholm, Sweden KR 50

Design rules to minimize sensitivity to ionizing radiation especially regarding latch-up problems are reported. Physical properties of latch-up and principles by which latch-up can be eliminated are outlined. A simulation program was developed, which shows that latch-up characteristics can be checked with an ordinary electrical method, when a special test circuit is mounted on a chip. No correlation can be determined between such measurements and the celerity level test for latch-up with the ionizing radiation method. ESA

N88-15918# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. Fuer Extraterrestrische Physik.
REALIZATION OF ACTIVE HIGH PASS FILTERS FOR GROUP VELOCITY CORRECTION [REALISIERUNG ION AKTIVEN ALPAESSEN ZUR GRUPPENLAUFZEITKORREKTUR]
Georg Saemann Jun. 1987 139 p In GERMAN
(MPE-In-Rept-47; ISSN-0178-0719; ETN-88-90795) Copyright Avail: NTIS HC A07/MF A01

A velocity correction method which can also be used for analog signal processing is presented. It is possible to use the high pass technique for digital filters. A uniform distribution of the group velocity can only be achieved in two stages: an error analysis (root mean square errors) followed by an approximation via Tchebyscheff or Gauss equations. Computing methods used in transfer functions of active RC circuits are analyzed and the passage from active RC circuits to the high pass technique is commented on. An example of a group velocity calculation of a low pass filter of fourth degree, in the frequency range 0 to 60 Hz is given. ESA

N88-15919# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
INVESTIGATION OF SELF-DISCHARGE CHARACTERISTICS OF SPACECRAFT NICKEL-CADMIUM CELLS AT ELEVATED TEMPERATURES
Samuel W. Donley, James H. Matsumoto, Talmadge M. Poston, Warren C. Hwang, and Alonzo Prater 15 Aug. 1987 27 p
(Contract F04701-85-C-0086)
(AD-A186497; TR-0086(6506-21)-1; SD-TR-87-45) Avail: NTIS HC A03/MF A01 CSCL 10C

Little is known concerning the self-discharge and heat generation in nickel-cadmium (NiCd) cells when they are subjected to temperatures far in excess of ambient. The work reported here provides such data for initially fully charged cells heated externally to temperatures from 44 to 118C. The cells (35 Ah nominal capacity) were placed into precalibrated insulating liners wired for cell heating; then, the insulated cells were heated in a chamber to the preset initial test temperature. The heat subsequently generated by the open-circuited, charged cells was determined

from the cell temperatures and heat loss rates to the test apparatus. The temperature rises recorded for the cells were in the range of 0 C over a 16 hr period at an initial test temperature of 64 C, 1 C over 10 hr at the 82 C setpoint, and 81 C over 13 hr at the 85 C setpoint. At 118 C setpoint, the recorded cell temperature exceeded 220 C, and the cell ruptured at 0.7 hr after attaining the setpoint temperature. GRA

N88-15920# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
VALIDATION OF A STOCHASTIC MODEL TO DETERMINE FAILURE RATES FOR COMMUNICATION-ELECTRONIC SYSTEMS M.S. Thesis
Dennis G. Willeck Sep. 1987 123 p
(AD-A186536; AFIT/GLM/LSMA/87S-84) Avail: NTIS HC A06/MF A01 CSCL 09C

Currently mobile C-E War Readiness Spares Kit (WRSK) computations are not automated. They are determined during an annual meeting attended by system users and suppliers. However, the Air Force continues to study several methods and models to automate the process. This thesis reports validation results of one model. The model combines the operating and non-operating failure rates to predict C-E system failures for a specified period of time. This model uses operating failures distributed over operating hours and non-operating failures distributed over system power-up attempts. Validation results showed this model predicted C-E failures as good as current methods during periods of steady-state, long operating hours; however, it more accurately predicted failures during periods where operating and non-operating failures occurred. Therefore, the model can be applied to Air Force C-E WRSK computations. HQ USAF/LEYS should develop a policy to ensure C-E system users document the necessary data for application of this model. GRA

N88-15921# Naval Postgraduate School, Monterey, Calif.
PULSE WIDTH MODULATOR CONTROLLER DESIGN FOR A BRUSHLESS DC MOTOR POSITION SERVO M.S. Thesis
Vincent S. Rossitto Jun. 1987 337 p
(AD-A186618) Avail: NTIS HC A15/MF A01 CSCL 10B

Recent interest in positioning cruise missile flight control surfaces using electromechanical actuation has prompted a detailed study of brushless dc motor performance in such an application. While the superior response characteristics of these electronically commutated motors are particularly well suited to unidirectional velocity drives, destructive electrical transients associated with rotational reversals of the motor limit its positioning performance. This thesis involves computer aided design of a functionally robust brushless dc motor position controller using pulse width modulation. Lumped parameter model simulation and phase plane analysis were performed to attain a preliminary parametric design of the controller. Comprehensive electrical and mechanical analyses were conducted using detailed model simulation to arrive at the final design by parametric optimization. FORTRAN source code listings for all simulations discussed in this thesis are appended and were run on a personal computer. GRA

N88-15922# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE DESIGN AND IMPLEMENTATION OF SURFACE ACOUSTIC WAVE DEVICES FOR LINEAR FM AND A NEW NON-LINEAR FM PULSE COMPRESSION TECHNIQUE FOR RADAR APPLICATIONS M.S. Thesis
James C. Walker 1986 78 p
(AD-A186741; AFIT/CI/NR-87-50T) Avail: NTIS HC A05/MF A01 CSCL 09D

The purpose of this work is to design, fabricate, and compare dispersive SAW devices using both linear FM and a new non-linear FM scheme. This new non-linear FM scheme uses the Blackman function as the modulating signal of the FM waveform. Up-chirped and V-chirped devices for both linear and the new non-linear FM scheme and their corresponding matched filters are compared. Design considerations are discussed in detail. An efficient sampling algorithm (which can also be applied to other non-linearly modulated FM waveforms) developed to facilitate the design of the SAW devices is presented. GRA

N88-15797*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH-TEMPERATURE ELECTRONICS
Gary T. Seng *In its* Aeropropulsion '87. Session 4: Instrumentation and Controls Research Nov. 1987 10 p (For primary document see N88-15794 08-07)
Avail: NTIS HC A05/MF A01 CSCL 20F

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N88-15923# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
MEAN VELOCITIES AND REYNOLDS STRESSES IN THE JUNCTURE FLOW AND IN THE SHEAR LAYER DOWNSTREAM OF AN APPENDAGE Final Report
H. M. McMahon, P. Merati, and K. M. Yoo Sep. 1987 172 p
(Contract N00014-85-K-0234)
(AD-A185819; GIT-AER-87-4) Avail: NTIS HC A08/MF A01 CSCL 20D

Experimental measurements were carried out in an incompressible 3-dimensional turbulent shear layer at locations in the corner near the trailing edge and also downstream of an appendage mounted perpendicular to a flat plate. A fully developed turbulent boundary layer was growing on the plate. The symmetrical appendage had an elliptical nose and was aligned with the flow. Thickness of the boundary layer as it approached the appendage leading edge was 76 mm or 1.07 times the maximum thickness of the appendage. Shear layer thickness was small compared to the appendage span. As the oncoming boundary layer passed around the appendage, a strong secondary flow was formed which was dominated by a pair of streamwise vortices trailing downstream in the corner and into the shear layer behind the appendage. This secondary flow had major effect in redistributing both the mean flow and turbulence quantities throughout the shear layer, and this effect persisted to a significant degree up to at least 3 chord lengths behind the appendage leading edge. At the appendage trailing edge, the core of the vortex-like secondary flow was located at 8 percent of the shear layer thickness above the plate and 0.40 appendage thickness away from the trailing edge itself. At 3 chord lengths downstream of the appendage leading edge the core had moved away from the plate a distance corresponding to about 29 percent of the local shear layer thickness while simultaneously moving outboard to a distance of 0.80 appendage thicknesses from the plane of symmetry. GRA

N88-15924*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CRYOGENIC FLUID MANAGEMENT TECHNOLOGY WORKSHOP. VOLUME 1: PRESENTATION MATERIAL AND DISCUSSION
John C. Aydelott, ed. and William Devol, ed. (Sverdrup Technology, Inc., Middleburg Heights, Ohio.) Sep. 1987 386 p Workshop held in Cleveland, Ohio, 28-30 Apr. 1987
(NASA-CP-10001; E-3732; NAS 1.55:10001) Avail: NTIS HC A17/MF A01 CSCL 20D

The major objective of the workshop was to identify future NASA needs for technology that will allow the management of subcritical cryogenic fluids in the low gravity space environment. Workshop participants were asked to identify those technologies which will require in-space experimentation and are thus candidates for inclusion in the flight experiment being defined at the Lewis

Research Center. For individual titles, see N88-15925 through N88-15945.

N88-15925*# Air Force Astronautics Lab., Edwards AFB, Calif.
AF CRYOGENIC AND FLUID MANAGEMENT SPACECRAFT TECHNOLOGY PROGRAM
Roy Silver *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 7-20 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

Viewgraphs are given that outline the program objectives of long term cryogenic storage programs. Diagrams of the orbit transfer vehicle, thermal insulation blankets, cryogenic storage tanks, the advanced liquid feed experiment, and the acoustic measurement on satellite experiment are presented. The objectives, goals, and payoffs of the fluid management space experiment and the liquid droplet radiator are outlined. R.J.F.

N88-15926*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CRYOGENICS PROGRAM OVERVIEW
Stephen H. Castles *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 21-58 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

An overview of the cryogenics program of the Goddard Space Flight Center is given in viewgraph form. Goddard's role and the flight programs requiring cryogenics are outlined. Diagrams are given of the Cosmic Background Explorer, the Broad Band X-Ray Telescope, the Hubble Space Telescope, an adiabatic demagnetization refrigerator, a liquid cryogenic cooler for the Shuttle Glow Experiment, a liquid helium dewar, and the X-ray spectrometer on the Advanced X-Ray Astrophysics Facility. R.J.F.

N88-15927*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AMES RESEARCH CENTER CRYOGENICS PROGRAM
Peter Kittel *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 59-82 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

Viewgraphs describe the Ames Research Center's cryogenics program. Diagrams are given of a fluid management system, a centrifugal pump, a flow meter, a liquid helium test facility, an extra-vehicular activity coupler concept, a dewar support with passive orbital disconnect, a pulse tube refrigerator, a dilution refrigerator, and an adiabatic demagnetization cooler. R.J.F.

N88-15928*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LERC CRYOGENIC FLUID MANAGEMENT PROGRAM OVERVIEW
E. P. Symons *In its* Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 83-97 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

An overview is given of the Lewis Research Center's cryogenic fluid management program in the form of viewgraphs. Objectives, approach, program elements, cost analysis, modeling, and flight experiment development are outlined. R.J.F.

N88-15929*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CRYOGENIC FLUID MANAGEMENT PROGRAM FLIGHT CONCEPT DEFINITION
Erich Kroeger *In its* Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 99-115 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

The Lewis Research Center's cryogenic fluid management program flight concept definition is presented in viewgraph form. Diagrams are given of the cryogenic fluid management subpallet and its configuration with the Delta launch vehicle. Information is given in outline form on feasibility studies, requirements definition, and flight experiments design. R.J.F.

N88-15930*# TRW, Inc., Redondo Beach, Calif.
SAMSS: AN IN-PROGRESS REVIEW OF THE SPACECRAFT ASSEMBLY, MAINTENANCE, AND SERVICING STUDY
William W. Burt *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 117-137 (For primary document see N88-15924 08-34)
(Contract F04701-86-C-0032)
Avail: NTIS HC A17/MF A01 CSCL 20D

The Spacecraft Assembly, Maintenance, and Servicing Study (SAMSS) is an effort to define and verify the most cost effective approach to spacecraft servicing, as a alternative to replacement, in the 1990's and beyond. The intent of the study is to assess the servicing of satellites in all orbit regimes. Elements of a space servicing infrastructure are developed and cost estimates are generated. Readiness is assessed and proof of concept demonstrations are identified. Cryogenic fuel resupply is discussed. Author

N88-15931*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ORBITAL TRANSFER VEHICLE STUDIES OVERVIEW **c18**
Don Perkinson *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 139-150 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 22B

An overview is given in viewgraph form of orbital transfer vehicle concept definition and systems analysis studies. Project development flow charts are shown for key milestones from 1985 until 1997. Diagrams of vehicles are given. Information is presented in outline form on technology requirements, cooling of propellant tanks, cryogenic fluid management, quick connect/disconnect fluid interfaces and propellant mass transfer. R.J.F.

N88-15932*# General Dynamics Corp., San Diego, Calif. Space Systems Div.
LARGE CAPACITY CRYOPROPELLANT ORBITAL STORAGE FACILITY **c28**
J. R. Schuster *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 151-174 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 21I

A comprehensive study was performed to develop the major features of a large capacity orbital propellant storage facility for the space-based cryogenic orbital transfer vehicle. Projected propellant usage and delivery schedules can be accommodated by two orbital tank sets of 100,000 lb storage capacity, with advanced missions expected to require increased capacity. Information is given on tank pressurization schemes, propellant transfer configurations, pump specifications, the refrigeration system, and flight tests. R.J.F.

N88-15933*# Analex Corp., Fairview Park, Ohio.
SPACE ENVIRONMENTAL CONSIDERATIONS FOR A LONG-TERM CRYOGENIC STORAGE VESSEL
Shigeo Nakanishi *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 175-191 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

Information is given on the kind of protection that is needed against impact and perforation of a long-term cryogenic storage vessel in space by meteoroids and space debris. The long-term effects of the space environment on thermal control surfaces and

coatings, and the question of whether the insulation and thermal control surfaces should be encased in a vacuum jacket shell are discussed. R.J.F.

N88-15934*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACE INFRARED TELESCOPE FACILITY (SIRTF) DESIGN AND THERMAL ANALYSIS c89
Jeffrey H. Lee *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 193-220 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 03A

The design and performance characteristics of an observatory are compared with those of a storage dewar. The critical design technologies required to increase cryogen dewar lifetime are discussed. In particular, outer shell temperature, vapor cooled shields, multilayer insulation performance, and tank support systems are analyzed to assess their impact on cryogen lifetime for both the observatory and the storage dewar. The cryogen lifetime and cryogen mass loss rate of the Space Infrared Telescope Facility (SIRTF) are compared with that of the Infrared Astronomy Satellite and the Cosmic Background Explorer Satellite. A 0.1 percent mass loss per day of superfluid helium dewar can be designed using current state-of-the-art dewar technology. Space-based liquid hydrogen and liquid oxygen tanks can be designed for a 5-year lifetime. Author

N88-15935*# Analex Corp., Fairview Park, Ohio.
THERMAL ANALYSIS FOR THE CRYOGENIC FLUID MANAGEMENT FLIGHT EXPERIMENT (CFMFE) c35
George R. Smolak *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 221-239 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 14B

The purpose was to identify recent thermal analysis efforts and to review that part of the analysis that addresses the prediction of fluid and container temperature gradients during low gravity storage in space. It was concluded that both small and large tanks require hundreds of hours to reach even 60 PSIA. In about 1000 hours, the small tank is close to equilibrium; the large tank requires many thousands of hours to reach equilibrium. R.J.F.

N88-15936*# Ball Aerospace Systems Div., Boulder, Colo.
DEVELOPMENT OF ON-ORBIT FLUID GAGING TECHNIQUES
Allan Mord *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 241-251 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

The objective was to measure liquid mass to plus or minus 1 percent in two-phase tanks in orbit. Viewgraphs present information on concept selection, program status and anticipated results. The program aims at test results showing 1 percent accuracy, the development of a breadboard test article usable in the lab or aboard a KC-135, and a concept that will permit flight article design to proceed. R.J.F.

N88-15937*# McDonnell-Douglas Corp., St. Louis, Mo.
LOW-g PROPELLANT GAGING c35
George Orton *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 253-268 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 14B

A program to develop and demonstrate technology for low gravity propellant gaging on future geostationary satellites is described. Evaluations were performed to select four gaging concepts for ground tests and low gravity tests in the NASA KC-135 aircraft. The selected concepts were: (1) an ultrasonic point sensor system, (2) a nucleonic gaging system, (3) an ultrasonic torsional wave guide, and (4) an ultrasonic flowmeter. As a result of successful ground and KC-135 tests, two concepts (the ultrasonic point sensor and the nucleonic systems) were selected for orbital test in a shuttle Get-Away-Special experiment. Author

N88-15938*# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering and Applied Mechanics.
REVIEW OF NUCLEATION AND INCIPIENT BOILING UNDER POOL AND FORCED CONVECTION CONDITIONS
Herman Merte, Jr. *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 269-299 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

An overview of liquid-vapor nucleation is given. The result of thermodynamic equilibrium across curved liquid-vapor interfaces is presented. The extension of this to include the interaction with idealizations of surface cavities is made to demonstrate how superheat requirements for nucleation will be affected by surface roughness, flow velocity and buoyancy. Experimental measurements of high liquid superheats and nucleation delay times are presented as examples of homogeneous nucleation. Examples of nucleation and boiling on smooth glass substrates and on metal surfaces with various surface roughnesses are presented. Author

N88-15939*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
VAPOR CONDENSATION ON A TURBULENT LIQUID INTERFACE
M. R. Helmick, B. C. Khoo, and A. A. Sonin *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 301-315 (For primary document see N88-15924 08-34)
(Grant NAG3-731)
Avail: NTIS HC A17/MF A01 CSCL 20D

An experimental investigation which seeks the fundamental relationship between the interfacial condensation rate and the parameters which control it when the liquid side is turbulent is discussed. The scaling laws for free-surface condensation are discussed for this case. It is argued that the condensation of cryogenic liquids can, in principle, be simulated in experiments using steam and water. Data are presented for the condensation rate in torms of the dimensionless scaling parameters which involve the fluid properties and the liquid-side turbulence velocity and length scales. Author

N88-15940*# Washington Univ., St. Louis, Mo.
COMPUTATIONAL PREDICTION OF PROPELLANT REORIENTATION c28
John I. Hochstein *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 317-344 (For primary document see N88-15924 08-34)
(Grant NAG3-578)
Avail: NTIS HC A17/MF A01 CSCL 21I

Viewgraphs from a presentation on computational prediction of propellant reorientation are given. Information is given on code verification, test conditions, predictions for a one-quarter scale cryogenic tank, pulsed settling, and preliminary results. R.J.F.

N88-15941*# Southwest Research Inst., San Antonio, Tex.
LOW GRAVITY LIQUID MOTIONS IN SPACECRAFT
Franklin T. Dodge *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 345-354 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

Low gravity liquid motions in a spacecraft are discussed in outline form and on viewgraphs. Free-surface sloshing, liquid draining, liquid reorientation, and sloshing in a bladdered tank are covered. Conclusions and recommendations are given. R.J.F.

N88-15942*# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
PEACEKEEPER TANK SLOSH MODEL
Sidney H. Schwartz *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 355-368 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

Information on a tank slosh model for Peacekeeper missiles is given in viewgraph form. Allowable vehicle errors for nose cone ejection clearance, vehicle maneuver sloshing problems, slosh/moment prediction, slosh surface specification, code validation, experimental model-computational model comparison and the propellant storage assembly are covered. R.J.F.

N88-15943*# Sundstrand Corp., Rockford, Ill.
ZERO-G THERMODYNAMIC VENT SYSTEM FOR SHUTTLE/CENTAUR c18
Richard E. Niggemann *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 369-376 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 22B

Viewgraphs are presented showing drawings of Centaur configurations, the Thermodynamic Vent System (TVS), the mixer pump, and the hydrogen vent motor pump inverter. A cryogenic performance summary is given in chart form. The TVS liquid flow operation and vapor flow operation are diagrammed. R.J.F.

N88-15944*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GODDARD SPACE FLIGHT CENTER MECHANICAL COOLER PROGRAM c31
Stephen H. Castles *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 377-385 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 13B

The Philips Stirling Cooler Program will ensure that a cooler is available to meet NASA's needs in the 40 to 120K temperature range in the 1990's. The Creare turbomachinery based cooler may provide an improved cooler for the 40 to 120K range. The design of advanced multistage coolers for use down to 2K will begin in 1988. Requirements, the history of the Stirling cooler, features of the photoflight cooler, advantages of the Philips cooler, mechanical reliability, and potential advantages of the Creare reverse Brayton cycle cooler are presented in viewgraph form.
Author

N88-15945*# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
AIR FORCE CRYOCOOLER DEVELOPMENT FOR SPACECRAFT c31
William L. Haskin *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 387-388 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 13B

An overview is given of Air Force sponsored cryocooler development for long duration spacecraft missions. Alternate approaches are being pursued to insure eventual success. The types of closed cycle cryocoolers that are now in advanced development include Vuilleumier, turbo-Brayton, and rotary-reciprocating refrigerators. Linear Stirling coolers with magnetic bearings have also been jointly sponsored by NASA and the Air Force. Technology is also being explored for future coolers using magnetic materials at low temperatures and for refrigerators with sorption compressors. All of these cryocoolers are presently configured primarily for use with infrared sensor systems, but the designs could be adapted for use with cryogenic fluid storage systems or other applications. Author

N88-15946# Haut Commissariat a la Recherche, Algiers (Algeria). Centre d'Etudes Nucleaires et Solaires.
INFLUENCE OF THE FRICTION COEFFICIENTS, THE POWER AND THE FLOWRATE ON THE TWO-PHASE FLOW INSTABILITIES IN NATURAL CIRCULATION Ph.D. Thesis
A. M. Kerris Apr. 1987 124 p In FRENCH
(DE88-700036; INIS-mf-10966) Avail: NTIS (US Sales Only) HC A06/MF A01

A study of non-linear effects of two phase flow instabilities has been done using theoretical and experimental models. The experimental model is based on a boiling channel placed in a water loop of natural convection. Studies of stability, with introduction of fluctuations over different parameters, have been achieved using the two models. The results of the experimental model agree with those of the theoretical model. It was found that the head loss coefficients K sub I and K sub E of the inlet and outlet channel respectively, had an influence over the stability of the system. An increase in the former produces an increase in the stability while an increase in the latter has the effect of increasing the instability. In the experiment, oscillations of the flow rate were observed. Two types of oscillations were noticed: (1) small oscillations called pressure drop oscillations, and (2) large oscillations called density wave oscillations. A study of the variation of these two types of oscillations with power and the coefficient K sub I and K sub E had been achieved. It was found that pressure drop oscillations disappeared with the increase of power and the density waves oscillations increased with the increase of power.
DOE

N88-15947# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
[NUMERICAL SIMULATION OF HEAT TRANSFER TURBULENCE, VOLUME 2] Final Report, 1 Oct. 1984 - 30 Nov. 1986
Steven A. Orszag May 1987 52 p
(Contract F49620-85-C-0026; AF Proj. 2307)
(AD-A185130; AFOSR-87-1349TR-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 20D

Papers are presented which give the final and major results of this research project. The results include: (1) the development and application of the renormalization group method to the calculation of fundamental constants of turbulence, the building of turbulence transport models, and large eddy simulations; (2) the application of RNG methods to turbulent heat transfer through the entire range of accessible Reynolds numbers; (3) the discovery that high Reynolds number turbulent flows tend to act as if they had weak nonlinearities; (4) the further analysis of secondary instability mechanisms in free shear flows; (5) the further development of numerical simulations of turbulent spots in wall bounded shear flows; (6) the study of cellular automata for the solution of fluid mechanical problems; and (7) the analysis of hyperscale instability as a mechanism for destabilization of coherent flow structures. For individual titles, see N88-15948 through N88-15948.

N88-15948# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
NUMERICAL SIMULATION OF TURBULENT SPOTS IN CHANNEL AND BOUNDARY LAYER FLOWS
Edward T. Bullister and Steven A. Orszag (Princeton Univ., N. J.) *In* Princeton Univ., Numerical Simulation of Heat Transfer Turbulence, Volume 2 May 1987 37 p (For primary document see N88-15947 08-34)
Avail: NTIS HC A04/MF A01 CSCL 20D

The initiation and early growth of spots in channel and boundary layer flows is simulated using a three dimensional spectral code. The simulated spots show significant agreement with available experimental data for such quantities as growth rates and spreading angles. Disturbances are introduced into the center and edge of the developing channel spots to investigate the relative sensitivity of spots. Author

N88-15949*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
A COMPUTATIONALLY EFFICIENT MODELLING OF LAMINAR SEPARATION BUBBLES Semiannual Status Report, Jun. 1987 - Jan. 1988
Mark D. Maughmer Feb. 1988 18 p
(Grant NAG1-778)
(NASA-CR-182417; NAS 1.26:182417) Avail: NTIS HC A03/MF A01 CSCL 20D

The goal of this research is to accurately predict the characteristics of the laminar separation bubble and its effects on airfoil performance. To this end, a model of the bubble is under development and will be incorporated in the analysis section of the Eppler and Somers program. As a first step in this direction, an existing bubble model was inserted into the program. It was decided to address the problem of the short bubble before attempting the prediction of the long bubble. In the second place, an integral boundary-layer method is believed more desirable than a finite difference approach. While these two methods achieve similar prediction accuracy, finite-difference methods tend to involve significantly longer computer run times than the integral methods. Finally, as the boundary-layer analysis in the Eppler and Somers program employs the momentum and kinetic energy integral equations, a short-bubble model compatible with these equations is most preferable. Author

N88-15950# Oak Ridge National Lab., Tenn.
COMPARISON OF A THERMOELECTRIC COOLING SYSTEM AND A GROUNDWATER HEAT PUMP
V. C. Mei, F. C. Chen, and B. Mathiprakasam 1987 5 p Presented at the Advanced Energy Systems Session of the ASME, Boston, Mass., 13 Dec. 1987 Prepared in cooperation with Midwest Research Inst., Kansas City, Mo.
(Contract DE-AC05-84OR-21400)
(DE88-001753; CONF-871238-1) Avail: NTIS HC A02

The performance of a groundwater thermoelectric (TE) heat pump system, based on today's state of the art TE materials, was calculated and compared with that of a conventional groundwater heat pump under the same water inlet temperature and flow rate. It was found that the TE system was quite competitive for cooling, particularly for the groundwater temperatures below 18 C (64 F). The TE system performed poorly for heating mode operation. A cooling coefficient of performance (COP) of 6.4 could be realized by a properly designed TE system at a ground water of temperature of 13 C, compared with a COP of 4.35 for a conventional heat pump. For heating mode operation at the same water temperature, the TE system achieved a COP of 1.82, while the conventional heat pump performed at a COP of 3.72. TE systems for many buildings, where part of the areas require year-round cooling, can be a good alternative if ground water or sufficiently low temperature is available. DOE

N88-15951# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
COMPUTATIONAL FLUID DYNAMICS
Mar. 1987 475 p Lecture series held in Rhode-Saint-Genese, Belgium, 2-6 Mar. 1987
(VKI-LS-1987-04; ISSN-0377-8312; ETN-88-91161) Avail: NTIS HC A20/MF A01

Upwind formulations of Euler equations, upwind principles for multidimensional Euler equations, integration of the Navier Stokes equations in finite volume formulation, finite element methods for compressible flows, time accurate techniques, adaptive finite difference methods, and nonequilibrium reacting flows are discussed. For individual titles, see N88-15952 through N88-15959.

N88-15952# Politecnico di Torino (Italy). Dipt. di Ingegneria Aeronautica e Spziale.
UPWIND FORMULATIONS FOR THE EULER EQUATIONS
Maurizio Pandolfi *In* Von Karman Inst. for Fluid Dynamics, Computational Fluid Dynamics Mar. 1987 84 p (For primary document see N88-15951 08-34)
Avail: NTIS HC A20/MF A01

Formulations involving two different approaches which lead to a decomposition of the flow variables in parts originating from waves with a well defined speed, amplitude, and propagation direction are discussed. The waves are defined without reference to any mesh dependent direction such as the coordinate directions or the direction of the normal to a finite volume boundary. The intrinsic decomposition can be applied in different ways to construct upwind schemes, conservative and nonconservative. ESA

N88-15953# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
A SURVEY OF UPWIND PRINCIPLES FOR THE MULTIDIMENSIONAL EULER EQUATIONS
H. Deconinck *In its* Computational Fluid Dynamics Mar. 1987 83 p (For primary document see N88-15951 08-34)
Avail: NTIS HC A20/MF A01

The use of decomposition (or splitting) to construct first order upwind differencing schemes, the use of upwinding principles for the Euler equations in two space dimensions, applications of flow dependent decompositions, and the interpretation of the upwind differencing schemes as approximate Riemann solvers are discussed. It is shown that the decompositions can be used to construct intrinsic two dimensional upwind schemes, in conservative and nonconservative form. ESA

N88-15954# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
INTEGRATION OF NAVIER-STOKES EQUATIONS IN FINITE VOLUME FORMULATION
W. Kordulla *In* Von Karman Inst. for Fluid Dynamics, Computational Fluid Dynamics Mar. 1987 65 p (For primary document see N88-15951 08-34)
Avail: NTIS HC A20/MF A01

Basic considerations for the numerical integration of the Navier-Stokes equations in finite-volume or integral formulation are presented. The main features of finite volume schemes are discussed. Results presented concern transonic flow simulations. It is shown that finite volume and finite difference formulations of the governing equations differ only in the fashion the metric terms are determined. ESA

N88-15955# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
CHARACTERISTIC FLUX AVERAGING APPROACH TO THE SOLUTION OF EULER'S EQUATIONS
Albrecht Eberle *In* Von Karman Inst. for Fluid Dynamics, Computational Fluid Dynamics Mar. 1987 61 p (For primary document see N88-15951 08-34)
Avail: NTIS HC A20/MF A01

A form of the Euler equation which is particularly well suited to the finite volume approach is considered. Since only solutions of the steady state are studied, the Jacobian determinant is taken as a local constant. The motivation for upwinding for hyperbolic conservation laws is discussed. Flow calculations showing the versatility of the approach are included. ESA

N88-15956*# University Coll. of Swansea (Wales). Inst. for Numerical Methods in Engineering.
FINITE ELEMENT METHODS FOR COMPRESSIBLE FLOWS
K. Morgan and J. Peraire *In* Von Karman Inst. for Fluid Dynamics, Computational Fluid Dynamics Mar. 1987 116 p (For primary document see N88-15951 08-34)
(Grant NAGw-478)
Avail: NTIS HC A20/MF A01 CSCL 20D

The problems of mesh generation and developing effective algorithms for the solution of the equations of compressible flow on unstructured meshes are discussed. Adaptive mesh refinement methods can be implemented in a straightforward manner. Possible adaptive strategies are examined. A finite element method adapted to problems involving high speed compressible flow is described. The adaptive mesh regeneration procedure appears to offer the

possibility of large computational savings in three dimensional flow computation. ESA

N88-15957# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
TIME ACCURATE TECHNIQUES USING CHARACTERISTIC FLUX AVERAGING WITH APPLICATION TO UNSTEADY AERODYNAMICS c02
Ronald Deslandes *In* Von Karman Inst. for Fluid Dynamics, Computational Fluid Dynamics Mar. 1987 47 p (For primary document see N88-15951 08-34)
Avail: NTIS HC A20/MF A01

Mathematical manipulations of the flow equations are done to achieve an arbitrary description of all kinds of unsteady situations occurring in inviscid flows. Pitching, pulsing, heaving, and rotating walls are enclosed in this approach. The numerical characteristics of the time accurate approach are emphasized, showing how to build up various schemes in order to achieve different levels of time accuracy with implicit and explicit schemes. ESA

N88-15958*# New York Univ., New York. Courant Inst. of Mathematical Sciences.
ADAPTIVE FINITE DIFFERENCE METHODS IN FLUID DYNAMICS
Marsha J. Berger *In* Von Karman Inst. for Fluid Dynamics, Computational Fluid Dynamics Mar. 1987 50 p Previously announced as N87-21286 (For primary document see N88-15951 08-34)
(Grant NAG1-457)
Avail: NTIS HC A20/MF A01 CSCL 20D

An adaptive method to solve partial differential equations in fluid mechanics is presented. The approach requires internal boundary conditions that must be conservative, data structures for keeping track of several layers of fine grid patches, error estimation, and heuristics for automatic grid generation. In practical calculations gains in computer efficiency up to 10 over nonadaptive methods are observed. The whole procedure takes 3000 lines of FORTRAN code. ESA

N88-15959# Politecnico di Milano (Italy). Dipt. di Energetica.
NONEQUILIBRIUM REACTING FLOWS
Claudio Bruno *In* Von Karman Inst. for Fluid Dynamics, Computational Fluid Dynamics Mar. 1987 53 p (For primary document see N88-15951 08-34)
Avail: NTIS HC A20/MF A01

A mathematical description of reaction kinetics including high temperature and unsteady flow environments is presented. Mathematical models, transport properties, algorithms, wall boundary conditions, and computerized procedures are included. Results concerning a flat plate geometry and physical conditions similar to those found near the end of laminar regime for the Hermes orbiter are presented. ESA

N88-15960 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
FINITE ELEMENT CALCULATION METHODS AND THEIR APPLICATION TO TURBOMACHINERY FLOWS, VOLUME 1
May 1987 436 p Lecture series held in Rhode-Saint-Genese, Belgium, 11-15 May 1987
(VKI-LS-1987-05-Vol-1; ETN-88-91162) Copyright Avail: Issuing Activity

Finite element fundamentals, computer implementation of finite element methods, and the formulation of inviscid rotational flow problems by velocity potential and stream function methods are introduced. For individual titles, see N88-15961 through N88-15964.

N88-15961 Concordia Univ., Montreal (Quebec). Dept. of Mechanical Engineering.
FINITE ELEMENT FUNDAMENTALS, PART 1
W. G. Habashi *In* Von Karman Inst. for Fluid Dynamics, Finite Element Calculation Methods and Their Application to Turbomachinery Flows, Volume 1 May 1987 65 p (For primary document see N88-15960 08-34)
Copyright Avail: Issuing Activity

Finite element fundamentals and the direct, variational, and weighted residual approaches are introduced. It is shown that in problems where a variational principle exists, the variational finite element method and the Galerkin finite element method yields identical discretized equations. ESA

N88-15962 Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
FINITE ELEMENT FUNDAMENTALS, PART 2
J. N. Reddy *In* Von Karman Inst. for Fluid Dynamics, Finite Element Calculation Methods and Their Application to Turbomachimery Flows, Volume 1 May 1987 65 p (For primary document see N88-15960 08-34)
Copyright Avail: Issuing Activity

Finite element fundamentals, limited to the weighted residual finite element formulations of heat transfer and potential flow problems such as the problems described by the Poisson or Laplace equations, are introduced. ESA

N88-15963 Purdue Univ., Indianapolis, Ind. Lab. of Computational Fluid Dynamics.
FINITE ELEMENT METHOD COMPUTER IMPLEMENTATION
H. U. Akay *In* Von Karman Inst. for Fluid Dynamics, Finite Element Calculation Methods and Their Application to Turbomachinery Flows, Volume 1 May 1987 140 p (For primary document see N88-15960 08-34)
Copyright Avail: Issuing Activity

A computer program intended to be used as a teaching tool, to perform numerical experiments and to practice minor program modifications is described. Example problems chosen from fluid mechanics and heat transfer areas are presented. Isoparametric transformations and the evaluation of the element matrices and vectors are also described. Techniques used in imposing the essential boundary conditions at the nodal points are outlined. ESA

N88-15964 Concordia Univ., Montreal (Quebec). Dept. of Mechanical Engineering.
INVISCID FLOWS, PART 1: FORMULATION OF INVISCID ROTATIONAL FLOW PROBLEMS BY VELOCITY POTENTIAL AND STREAM FUNCTION METHODS. APPLICATIONS TO TURBOMACHINES
W. G. Habashi *In* Von Karman Inst. for Fluid Dynamics, Finite Element Calculation Methods and Their Application to Turbomachinery Flows, Volume 1 May 1987 152 p (For primary document see N88-15960 08-34)
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Governing equations and boundary conditions, the potential formulation of transonic flows, the subsonic internal and turbomachinery flows, and transonic turbomachinery flow are introduced. ESA

N88-15965 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
FINITE ELEMENT CALCULATION METHODS AND THEIR APPLICATION TO TURBOMACHINERY, VOLUME 2
May 1987 481 p Lecture series held in Rhode-Saint-Genese, Belgium, 11-15 May 1987
(VKI-LS-1987-05-Vol-2; ETN-88-91163) Copyright Avail: Issuing Activity

The study of inviscid and viscous flows, the formulation of Navier-Stokes equations by stream function-vorticity methods, flow equations, and the generation of computational grids are discussed. For individual titles, see N88-15966 through N88-15971.

N88-15966 Purdue Univ., Indianapolis, Ind. Lab. of Computational Fluid Dynamics.
INVISCID FLOWS, PART 2
H. U. Akay and A. Ecer *In* Von Karman Inst. for Fluid Dynamics, Finite Element Calculation Methods and their Application to Turbomachinery Flows, Volume 2 May 1987 265 p (For

primary document see N88-15965 08-34)
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Finite element calculation methods applied to the study of turbomachinery flows are presented. Variational principles for Euler equations, the Euler equations for flows through rotating turbomachinery passages, the finite element formulation of steady potential flows, and the implementation of the Kutta condition are included. ESA

N88-15967 Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
VISCOUS FLOWS, PART 1
J. N. Reddy and A. Ecer *In* Von Karman Inst. for Fluid Dynamics, Finite Element Calculation Methods and their Application to Turbomachinery Flows, Volume 2 May 1987 79 p (For primary document see N88-15965 08-34)
Copyright Avail: Issuing Activity

Finite element calculation methods and their application to turbomachinery flows are presented. The governing equations, turbulent flows, incompressible viscous flows, computational schemes, and the penalty function method are covered. ESA

N88-15968 Purdue Univ., Indianapolis, Ind. Lab. of Computational Fluid Dynamics.
VISCOUS FLOWS, PART 2
A. Ecer and P. Ward *In* Von Karman Inst. for Fluid Dynamics, Finite Element Calculation Methods and their Application to Turbomachinery Flows, Volume 2 May 1987 36 p (For primary document see N88-15965 08-34)
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The finite element formulations discussed in the previous section is continued. However, as discussed in the present viscous flow section, the Navier-Stokes equations written either in terms of primitive variables u, v, p or stream functions and vorticities do not allow a concise formulation. In the previous sections, the finite element method was summarized when using a weighting function in a Galerkin formulation. This is a general approach. However, it does not provide much insight to either the basic characteristics of the equations or the physical phenomenon they are attempting to model. In fact, the penalty function formulation, as previously discussed, tries to model a particular difficulty in analyzing incompressible flows in a more appropriate way. The condition of incompressibility turns out to be very important in the solution of the basic set of equations. The considerations are extended to develop a general variational formulation of viscous flows. The variational formulations are presented for viscous flows by using a Clebsch formulation. The formulation basically follow the discussion for inviscid flows but with the inclusion of viscous terms and resulting modifications. ESA

N88-15969 Concordia Univ., Montreal (Quebec). Dept. of Mechanical Engineering.
VISCOUS FLOWS. PART 3: FORMULATION OF THE NAVIER-STOKES EQUATIONS BY STREAM FUNCTION VORTICITY METHODS
W. G. Habashi *In* Von Karman Inst. for Fluid Dynamics, Finite Element Calculation Methods and their Application to Turbomachinery Flows, Volume 2 May 1987 29 p (For primary document see N88-15965 08-34)
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Navier-Stokes equations in primitive variables form and in stream function - vorticity form, and the solution of these using the segregated formulation and coupled formulations are introduced. It is shown that the finite element method is well suited to the formulation of the stream function - vorticity problem. Stable solutions are obtained with no upwinding for subsonic flows and with only upwinding the potential equations for transonic flows. ESA

N88-15970 Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
REVIEW OF THE EQUATIONS OF FLUID MECHANICS AND HEAT TRANSFER
J. N. Reddy *In* Von Karman Inst. for Fluid Dynamics, Finite Element Calculation Methods and their Application to Turbomachinery Flows, Volume 2 May 1987 29 p (For primary document see N88-15965 08-34)
Copyright Avail: Issuing Activity

The basic equations of continuum mechanics, especially fluid mechanics and heat transfer, are introduced. Newtonian fluid mechanics and heat transfer in solids are also discussed. ESA

N88-15971 Purdue Univ., Indianapolis, Ind. Lab. of Computational Fluid Dynamics.
MESH GENERATION
A. Ecer *In* Von Karman Inst. for Fluid Dynamics, Finite Element Calculation Methods and their Application to Turbomachinery Flows, Volume 2 May 1987 39 p (For primary document see N88-15965 08-34)
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Computational grids for complex three dimensional flow geometries, and a finite element grid generation scheme based on multiple block structures are introduced. The procedure can handle arbitrary geometries and is not restricted to modeling single shapes. ESA

N88-15972# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
INTRODUCTION TO THE MODELING OF TURBULENCE
Presented at a lecture series, Rhode Saint Genese, Belgium, 18-20 May 1987 May 1987 (For primary document see (VKI-LS-81-06; ISSN-0377-8312; ETN-88-91164) Avail: NTIS HC A18/MF A01

The fundamental physical and mathematical principles of turbulence modeling and the models are reviewed. Turbulence modeling through large eddy simulation is also introduced. For individual titles, see N88-15973 through N88-15978.

N88-15973# Manchester Univ. (England). Dept. of Mechanical Engineering.
AN INTRODUCTION TO SINGLE POINT CLOSURE METHODOLOGY **c47**
B. E. Launder *In* Von Karman Inst. for Fluid Dynamics, Introduction to the Modeling of Turbulence May 1987 90 p (For primary document see N88-15972 08-34)
Avail: NTIS HC A18/MF A01

The theory of closure procedures and the simplification procedures for the second moment equations are described. The principle of receding influence, stating that higher order correlations have less effect on the mean flow than the precedent level, is used to illustrate choices made on algebraic and computational convenience. A description of non-negligible viscous effects and their influence on turbulent transport is included. Wall function approaches in turbulence modeling are also described. ESA

N88-15974# Karlsruhe Univ. (West Germany). Inst. fuer Hydromechanik.
TURBULENCE MODELS FOR PRACTICAL APPLICATIONS **c47**
W. Rodi *In* Von Karman Inst. for Fluid Dynamics, Introduction to the Modeling of Turbulence May 1987 27 p Sponsored by Deutsches Forschungsgemeinschaft (For primary document see N88-15972 08-34)
Avail: NTIS HC A18/MF A01

Incompressible flow atmospheric turbulence models of the high Reynolds simplified version are described. Reynolds stresses and turbulent heat or mass fluxes appearing in the statistically averaged mean flow equation are determined. Prandtl's mixing length hypothesis is discussed. Energy equation models based on the use of a transport equation for a suitable velocity scale of the turbulent motion are examined. It is shown that mixing length hypothesis and related eddy viscosity models are not very suitable whenever turbulence transport and history effects are important. One equation models employing a transport equation are superior to mixing length models for nonequilibrium shear layers where the length scale distribution can be prescribed. ESA

N88-15975# Karlsruhe Univ. (West Germany). Inst. fuer Hydromechanik.
EXAMPLES OF TURBULENCE-MODEL APPLICATIONS c47
W. Rodi *In* Von Karman Inst. for Fluid Dynamics, Introduction to the Modeling of Turbulence May 1987 47 p Sponsored by Deutsches Forschungsgemeinschaft (For primary document see N88-15972 08-34)
Avail: NTIS HC A18/MF A01

Applications of incompressible flow atmospheric turbulence models of the high Reynolds simplified version type are presented. The relative performance of the different models is discussed. The examples include two dimensional shear layer flows, two dimensional separated flows, and three dimensional flows. Turbulence model performance is difficult to judge because the numerical accuracy that can be obtained in the more complex situations is questionable. ESA

N88-15976# Manchester Univ. (England). Dept. of Mechanical Engineering.
NUMERICAL IMPLEMENTATION AND PERFORMANCE OF REYNOLDS STRESS CLOSURES IN FINITE VOLUME COMPUTATIONS OF RECIRCULATING AND STRONGLY SWIRLING FLOWS
M. A. Leschziner *In* Von Karman Inst. for Fluid Dynamics, Introduction to the Modeling of Turbulence May 1987 69 p Sponsored in part by the United Kingdom Science and Engineering Research Council, the United Kingdom Ministry of Defence, British Aerospace, and Nielsen Engineering and Research, Inc. (For primary document see N88-15972 08-34)
Avail: NTIS HC A18/MF A01

Progress in computing complex recirculating and strongly swirling flow with Reynolds stress closures and nondiffusive discretization within the finite volume framework is presented. Results illustrate that stress closures provide, in virtually all circumstances, a superior representation of turbulent transport processes to that returned by the Boussinesq-viscosity model. This applies to mean flow and turbulence features, the latter being particularly relevant in the context of heat transfer and scalar transport. ESA

N88-15977# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. of Atmospheric Physics.
DIRECT AND LARGE EDDY SIMULATION OF TURBULENCE. SUMMARY OF THE STATE OF ART 1987
U. Schumann *In* Von Karman Inst. for Fluid Dynamics, Introduction to the Modeling of Turbulence May 1987 83 p (For primary document see N88-15972 08-34)
Avail: NTIS HC A18/MF A01

The basic approaches used to simulate turbulence are reviewed including the direct method (without using any phenomenological model), and simulations using large eddies. In the latter case proper subgrid scale models are required for scales of motion which are not resolved by the numerical method. It is shown that these tools for turbulence research can often compete with experiments, but they have heir own limitations and are not a replacement of other approaches. ESA

N88-15978# Rouen Univ. (France).
TURBULENCE MODELING FOR COMPRESSIBLE FLOWS
D. Vandromme and H. Haminh *In* Von Karman Inst. for Fluid Dynamics, Introduction to the Modeling of Turbulence May 1987 87 p (For primary document see N88-15972 08-34)
Avail: NTIS HC A18/MF A01

Averaging techniques, energy paths, the two zone concept for wall bounded flow analysis, methods to improve the evaluation of the eddy viscosity, and upgrading of the closure level are introduced. It is recognized that simple models are capable of solving a large proportion of practical problems. Where the explicit compressibility terms play a significant role in the mean flow, it appears that their use cannot be avoided. ESA

N88-15979# Technische Hogeschool Twente, Enschede (Netherlands). Faculty of Applied Mathematics.
A VARIATIONAL FORMULATION OF A HYDRODYNAMIC LUBRICATION PROBLEM
R. Verstappen Jul. 1987 25 p
(Memo-642; B8721003; ISSN-0921-1969; ETN-88-91597) Avail: NTIS HC A03/MF A01

The variational formulation for the creeping flow of a lubricant between rigid, moving bearings is considered. Starting from a physical principle of virtual power, the restriction to creeping flow leads to a variational formulation for the differential equations and boundary conditions. Performing the usual approximations, and extensions for higher order viscous effects that are based on the scaling of the problem directly into the functional, provides an energy like functional that correctly produces the Reynolds equation and (free) boundary conditions (even for a pressure dependent viscosity). This approximated functional differs from the functional usually obtained in an ad hoc way by an additional term. This term depends on the velocity difference of the bearings and gives insight into the range of validity of the usual set of equations. ESA

N88-15980# Ecole Centrale de Lyon (France). Lab. de Mecanique des Fluides.
MODELING THE UNSTEADY FLOW FOUND IN AXIAL TURBOMACHINERY Ph.D. Thesis [MODELISATION DES REGIMES D'ECOULEMENTS INSTATIONNAIRES RENCONTRES EN TURBOMACHINE AXIALE]
Salah Eddine FakherElAbiari 1987 296 p In FRENCH
(ECL-87-07; ETN-88-91620) Avail: NTIS HC A13/MF A01

A linear model which takes into consideration compressibility of either the steady or unsteady flow is developed. Attention is paid to flow stability in reduced overall flow condition. Outside blade-space, the three dimensional flow is replaced with two dimensional flow developed over axisymmetric surfaces. The experimental results obtained on mono- and multi-stage compressors agree reasonably with model predictions, with an accuracy of 5 percent at nominal flow, reduced to 10 percent at 80 percent flow. ESA

N88-15981# Ecole Centrale de Lyon (France). Lab. de Mecanique des Fluides.
EXPERIMENTAL STUDY OF SECONDARY FLOW IN THE PRESENCE OF TWO JET ARRAYS ON THE WALL OF A TURBINE BLADE Ph.D. Thesis [ETUDE EXPERIMENTALE DES ECOULEMENTS SECONDAIRES EN PRESENCE DE DEUX RANGEES DE JETS A LA PAROI D'UNE GRILLE DE TURBINE]
Abdelali Seddini 1987 154 p In FRENCH
(ECL-87-11; ETN-88-91622) Avail: NTIS HC A08/MF A01

A experimental study of the interaction of the secondary turbine flow with the cooling jets injected at the base of the blades is presented. Subsonic wind tunnel tests were carried on using a gas turbine wheel. The hot wire sensor and the five orifices pressure transducer used in the tests are described. The results allow a satisfactory description of the evolution of the jets in the space between blades and give some indications of the interactions of jets with secondary flows, passing vortices and between themselves. ESA

N88-15982# Institut Franco-Allemand de Recherches, St. Louis (France).
COMPUTER PROGRAM FOR THE CALCULATION OF THE PROFILE-VORTICES INTERACTIONS (TWO DIMENSIONAL INVISCID INCOMPRESSIBLE FLOW WITH POINT SINGULARITIES) [PROGRAMME DE CALCUL D'INTERACTION PROFIL/TOURBILLON (ECOULEMENT 2D NON VISQUEUX INCOMPRESSIBLE A SINGULARITES PONCTUELLES)]
J. Haertig 26 Aug. 1986 36 p In FRENCH
(Contract DRET-85-031)
(ISL-R-124/86; ETN-88-91645) Avail: NTIS HC A03/MF A01

The analytical results from velocity potential unsteady flow theory are used to carry out numerical simulations of the evolution

of the aerodynamical coefficients of a Jukowsky profile interacting with incident vortices. The program computes the coefficients, the vortex trajectory, and the wake of the profile. The most significant parameters are the circulation of the incident vortice and the minimum distance separating the profile from the vortice. ESA

N88-15983*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ON THE PERFORMANCE OF FINITE JOURNAL BEARINGS LUBRICATED WITH MICROPOLAR FLUIDS

M. M. Khonsari and D. E. Brewe (Army Aviation Research and Development Command, St. Louis, Mo.) 1988 22 p Proposed for presentation at the 1988 Annual Meeting of Tribologists and Lubrication Engineers, Cleveland, Ohio, 8-12 May 1988

(NASA-TM-100293; E-3939; NAS 1.15:100293; AVSCOM-TR-88-C-001) Avail: NTIS HC A03/MF A01 CSCL 20D

A study of the performance parameters for a journal bearing of finite length lubricated with micropolar fluids is undertaken. Results indicate that a significantly higher load carrying capacity than the Newtonian fluids may result depending on the size of material characteristic length and the coupling number. It is also shown that although the frictional force associated with micropolar fluid is in general higher than that of a Newtonian fluid, the friction coefficient of micropolar fluids tends to be lower than that of the Newtonian. Author

N88-15984*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE EFFECT OF EDDY DISTRIBUTION ON MOMENTUM AND HEAT TRANSFER NEAR THE WALL IN TURBULENT PIPE FLOW

Robert L. Zurawski, Stanley P. Grisnik, Terry L. Hardy, and Bahman Ghorashi (Cleveland State Univ., Ohio.) Dec. 1987 38 p

(NASA-TM-100257; E-3882; NAS 1.15:100257) Avail: NTIS HC A03/MF A01 CSCL 20D

A study was conducted to determine the effect of eddy distribution on momentum and heat transfer near the wall in turbulent pipe flow. The buffer zone was of particular interest in that it is perhaps the most complicated and least understood region in the turbulent flow field. Six eddy diffusivity relationships are directly compared on their ability to predict mean velocity and temperature distributions in turbulent air flow through a cylindrical, smooth-walled pipe with uniform heat transfer. Turbulent flow theory and the development of the eddy diffusivity relationships are briefly reviewed. Velocity and temperature distributions derived from the eddy diffusivity relationships are compared to experimental data for fully-developed pipe flow in turbulent air at a Prandtl number of 0.73 and Reynolds numbers ranging from 8100 to 25 000. Author

N88-15985# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

FRICTION DRAG REDUCTION (A SPECULATIVE ESSAY)

Francisco Leme Galvao Aug. 1987 5 p Presented at the 9th Brazilian Congress of Mechanical Engineering, Florianopolis, Brazil, 7-11 Dec. 1987

(INPE-4278-PRE/1150) Avail: NTIS HC A02/MF A01

The application of gas dynamics concepts can clarify and explain many aspects of aerodynamic phenomena. In the case of friction drag, this approach suggests some new possibilities for its reduction, such as the use of ultrasmooth surfaces having specific physical and chemical characteristics, or used in conjunction with a noble gas lubricating layer. Such possibilities are discussed in the text which, due to the multidisciplinary knowledge involved, is kept at a conceptual and heuristic level. Author

N88-15986# Oregon State Univ., Corvallis.

COMPARATIVE PERFORMANCE OF THE CONJUGATE GRADIENT AND SOR (SUCCESSIVE OVER RELAXATION) METHODS FOR COMPUTATIONAL THERMAL HYDRAULICS

John B. King, Samim Anghaie, and Henry M. Domanus 1987 8 p Presented at the Joint Meeting of the American Nuclear Society and the Atomic Industrial Forum, Los Angeles, Calif., 15 Nov. 1987 Prepared in cooperation with Florida Univ., Gainesville and Argonne National Lab., Ill.

(Contract W-31-109-eng-38)

(DE88-002553; CONF-871101-70) Avail: NTIS HC A02/MF A01

Finite difference approximations to the continuity, momentum, and energy equations in thermal hydraulics codes result in a system of N by N equations for a problem having N field points. In a three dimensional problem, N increases as the problem becomes larger or more complex, and more rapidly as the computational mesh size is reduced. As a consequence, the execution time required to solve the problem increases, which may lead to placing limits on the problem resolution or accuracy. A conventinal method of solution of these systems of equations is the Successive Over Relaxation (SOR) technique. However, for a wide range of problems the execution time may be reduced by using a more efficient linear equation solver. One such method is the conjugate gradient method which was implemented in COMMIX-1B thermal hydraulics code. It was found that the execution time required to solve the resulting system of equations was reduced by a factor of about 2 for some problems. This paper summarizes the characteristics of these iterative solution procedures and compares their performance in modeling of a variety of reactor thermal hydraulic problems, using the COMMIX-1B computer code. DOE

N88-15987# California Inst. of Tech., Pasadena. Div. of Engineering and applied Science.

CAVITATION INCEPTION SCALE EFFECTS. 1. NUCLEI DISTRIBUTIONS IN NATURAL WATERS. 2. CAVITATION INCEPTION IN A TURBULENT SHEAR FLOW

Timothy J. OHern May 1987 365 p

(Contracts N00014-83-K-0506; N00167-85-K-0165)

(AD-A186553; ENG-183.15) Avail: NTIS HC A16/MF A01 CSCL 20D

Investigations were made into the two major aspects of cavitation scale effects, susceptibility of the water to cavitation and flow field effects. In situ investigations of marine cavitation nuclei populations were made using underwater holography. Relatively high bubble concentrations during calm sea conditions, and their population inversion below the thermocline where organism activity was high, indicate a possible biological source of bubble production. Bubble sizes can be used to indicate that the average tensile strength of the ocean waters examined should be on the order of several thousands Pascals, with a minimum expected value of about one hundred. A concentration of at least 3 bubbles per cc in the 5 to 20 micrometer radius range is needed in test facility water to model marine conditions. The inception processes in a turbulent free shear layer were examined at Reynolds numbers up to 2 million. Two distinct types of vortex motion were evident, the primary spanwise and the secondary longitudinal vortices. Cavitation inception occurs in the secondary shear layer vortices and more fully developed cavitation is visible in both structures. A Rankine vortex model indicates that the secondary vortex strength is less than 10% of that of the primary structure. GRA

N88-15988# Naval Postgraduate School, Monterey, Calif.

INTERACTION OF A VORTEX PAIR WITH A FREE SURFACE M.S. Thesis

John Elnitsky, II Sep. 1987 114 p

(AD-A186619) Avail: NTIS HC A06/MF A01 CSCL 20D

The trailing vortices generated by the control planes of submarines give rise to surface signatures in the form of scars and striations. Two counter-rotating vortices were generated in a novel experimental system and their interaction with the free surface was investigated. In addition, the governing equations have been solved through the use of the boundary-element method for a representative Frounde number. The results have been expressed in terms of the depth of submergence of the vortices, their mutual induction velocity, and the initial vortex separation. It has been shown that the free surface begins to deform when the vortices are at a distance of about one initial vortex separation from the

free surface. The height of the maximum deformation is attained at a normalized time of about 0.1, when the vortices are at a distance of about 0.5b sub 0 from the free surface. The elevated part of the surface is bounded by two scars, whose motion is slaved to that of the vortices. GRA

N88-15989# McDonnell-Douglas Research Labs., St. Louis, Mo.
ACTIVE CONTROL OF JET FLOWFIELDS Final Technical Report, 1 Jan. 1983 - 31 Dec. 1985
Valdis Kibens and Richard W. Wlezien 29 Jun. 1987 39 p
(Contract F49620-83-C-0048)
(AD-A186736; MDC-Q1296; AFOSR-87-1476TR) Avail: NTIS HC A03/MF A01 CSCL 20D

Passive and active control of jet shear layer development were investigated as mechanisms for modifying the global characteristics of jet flowfields. Slanted and stepped indeterminate origin (I.O.) nozzles were used as passive, geometry-based control devices which modified the flow origins. Active control techniques were also investigated, in which periodic acoustic excitation signals were injected into the I.O. nozzle shear layers. Flow visualization techniques based on a pulsed copper-vapor laser were used in a phase-conditioned image acquisition mode to assemble optically averaged sets of images acquired at known times throughout the repetition cycle of the basic flow oscillation period. Hot wire data were used to verify the effect of the control techniques on the mean and fluctuating flow properties. The flow visualization images were digitally enhanced and processed to show locations of prominent vorticity concentrations. Three-dimensional vortex interaction patterns were assembled in a format suitable for movie mode on a graphic display workstation, showing the evolution of three-dimensional vortex system in time. GRA

N88-15791*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INLETS, DUCTS AND NOZZLES
John M. Abbott, Bernhard H. Anderson, and Edward J. Rice *In its* Aeropropulsion '87. Session 3: Internal Fluid Mechanics Research Nov. 1987 24 p (For primary document see N88-15790 08-07)
Avail: NTIS HC A04/MF A01 CSCL 20D

N88-16056# Florida Atlantic Univ., Boca Raton. Center for Acoustics and Vibrations.
FULLY TURBULENT INTERNAL FLOW EXCITATION OF PIPE SYSTEMS
J. M. Cuschieri, E. J. Richards, and S. E. Dunn *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 179-185 (For primary document see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 20D

N88-16148# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
A SEMIANALYTICAL SOLUTION OF THE HEAT CONDUCTION EQUATION FOR SEVERAL BOUNDARY CONDITIONS [EINE HALBANALYTISCHE LOESUNG DER WAERMELEITUNGS-GLEICHUNG BEI VERSCHIEDENEN RANDVORGABEN]
Barbara Hennemuth and Hans Joachim Oberle *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 43-49 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16151# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
DETERMINATION OF THE HEAT CONDUCTION COEFFICIENT OF THE SOIL FROM THE ADVANCE OF THE DIURNAL TEMPERTURE WAVE [BESTIMMUNG DES WAERMELEIT-KOEFFIZIENTEN DES BODENS AUX DEM VORDRINGEN DER TAEGLICHEN TEMPERATURWELLE]
Stephan Traup *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 62-67 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16506# Joint Publications Research Service, Arlington, Va.
REMOTE MEASUREMENT OF AEROSOL STREAM VELOCITY WITH CONTINUOUS-WAVE CO2-LASER Abstract Only
V. I. Bersenev, V. M. Gordiyenko, N. N. Kurochkin, A. V. Priyezzhev, and Yu. Ya. Putivskiy *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 46 Transl. into ENGLISH from Vestnik Moskovskogo Universiteta, Seriya 3: Fizika, Astronomiya (Moscow, USSR), v. 27, no. 6, Nov. - Dec. 1986 p 39-43 Original language document was announced in IAA as A87-41922 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources and Remote Sensing.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N88-15990# Ceskoslovenska Vedeckotechnicka Spolecnost, Prague.
TEMPERATURE METROLOGY '86
1986 17 p In CZECH and SLOVAK Presented at the National Conference on Temperature Metrology, Hradec Kralove, Czechoslovakia, 19 May 1986
(DE88-700236; INIS-mf-11029; CONF-8605302) Avail: NTIS (US Sales Only) HC A03/MF A01

The national conference was oriented to problems related to the calibration of thermometers and to correct measurement of temperature in workshops and laboratories, within the range of -200 to +3000 degrees C, and to contact thermometers. The application of metrology of temperature in nuclear power plants was discussed in two papers: Effect of nuclear reactor environment on thermoelectric sensor readings, and Calibration of temperature sensors in a nuclear reactor. DOE

N88-15991*# Houston Univ., Tex. Dept. of Electrical Engineering.
A KNOWLEDGE-BASED OBJECT RECOGNITION SYSTEM FOR APPLICATIONS IN THE SPACE STATION Annual Report, 1 Feb. 1987 - 31 Jan. 1988
Atam P. Dhawan 8 Feb. 1988 25 p
(Grant NAG9-203)
(NASA-CR-182411; NAS 1.26:182411) Avail: NTIS HC A03/MF A01 CSCL 14B

A knowledge-based three-dimensional (3D) object recognition system is being developed. The system uses primitive-based hierarchical relational and structural matching for the recognition of 3D objects in the two-dimensional (2D) image for interpretation of the 3D scene. At present, the pre-processing, low-level preliminary segmentation, rule-based segmentation, and the feature extraction are completed. The data structure of the primitive viewing knowledge-base (PVKB) is also completed. Algorithms and programs based on attribute-trees matching for decomposing the segmented data into valid primitives were developed. The frame-based structural and relational descriptions of some objects were created and stored in a knowledge-base. This knowledge-base of the frame-based descriptions were developed on the MICROVAX-AI microcomputer in LISP environment. The simulated 3D scene of simple non-overlapping objects as well as real camera data of images of 3D objects of low-complexity have been successfully interpreted. B.G.

N88-15992# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Lab. Associado de Plasmas.
GYROTRON DEVELOPMENT AT THE INSTITUTO DE PESQUISAS ESPACIAIS
J. J. Barroso, P. J. deCastro, R. A. Correa, G. P. Galvao, G. O. Ludwig, A. Montes, M. C. A. Nono, and J. O. Rossi Jul. 1987 12 p Presented at the Energy Independence Conference: Fusion Energy and Plasma Physics, Rio de Janeiro, Brazil, 17-21 Aug. 1987
(INPE-4240-PRE/1115) Avail: NTIS HC A03/MF A01

The conceptual design of a 35 GHz gyrotron operating in the TE sub 021 mode, intended for plasma heating experiments, is presented. The electrooptical system is synthesized from the electron beam parameters in the cavity region and the electrodynamical system includes a conventional resonator consisting of truncated cones. The starting and operating characteristics are calculated by integrating the exact equation of electron motion under the action of an RF field with fixed spatial distribution. For the moment, the experimental activities, in addition to providing all the infrastructure for the laboratory, are concentrated on the construction of a system of magnetic coils, able to generate a 15 kG magnetic induction with a fluctuation of 0.1 percent over an extension of 13 cm, on the manufacture of cavities by using electroforming techniques and on the development of techniques for the construction of electron guns. Author

N88-15993# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
THE HIGH RESOLUTION SPAGHETTI HADRON CALORIMETER
P. Jenni, P. Sonderegger, H. P. Paar, and R. Wigmans (European Organization for Nuclear Research, Geneva, Switzerland) 1987 28 p
(NIKHEF-H/87-7; B8721331; ETN-88-91602) Avail: NTIS HC A03/MF A01

It is proposed to build a prototype for a hadron calorimeter with scintillating plastic fibers as active material. The absorber material is lead. Provided that these components are used in the appropriate volume ratio, excellent performance may be expected, e.g., an energy resolution of 30%/rtE for jet detection. The proposed design offers additional advantages compared to the classical sandwich calorimeter structures in terms of granularity, hermiticity, uniformity, compactness, readout, radiation resistivity, stability, and calibration. ESA

N88-15994# Institut Franco-Allemand de Recherches, St. Louis (France).
STUDY ON CINERADIOGRAPHY [ETUDES SUR LA RADIOCINEMATOGRAPHIE]
T. Ebding 29 Aug. 1986 14 p In FRENCH
(Contract BMVg-T/R-760/F-0016/F-1716)
(ISL-R-120/86; ETN-88-91643) Avail: NTIS HC A03/MF A01

A device combining microchannelplate amplifiers with an ultrafast organic scintillator is used to obtain photographs for ballistic applications at a rate of more than 1 MHz. The electrons are accelerated to 15 kV to produce on the scintillator an image with a remanence of less than 10 ns. The X-ray source pulse duration is about 20 ns. The resulting radiographic image has a space resolution of 100 microns. ESA

N88-15995# Centro Informazioni Studi Esperienze, Milan (Italy).
ON LINE INSTRUMENT SYSTEMS FOR MONITORING STEAM TURBOGENERATORS [SISTEMI STRUMENTALI PER LA SORVEGLIANZA IN LINEA DI TURBOALTERNATORI A VAPORE]
A. Clapis, G. Giorgetti, G. L. Lapini, A. Benanti, C. Frigeri, E. Gadda, and E. Mantino (Ente Nazionale per l'Energia Elettrica, Milan, Italy) 1987 24 p In ITALIAN Presented at the Conference on Diagnostica Automatizzata o non degli Impianti Termici, Milan, Italy, 29 Apr. 1987
(CISE-3860; ETN-88-91648) Avail: NTIS HC A03/MF A01

A computerized real time data acquisition and data processing for the diagnosis of malfunctioning of steam turbogenerator systems is described. Pressure, vibration and temperature measurements are continuously collected from standard or special sensors including startup or stop events. The architecture of the monitoring system is detailed. Examples of the graphics output are presented. It is shown that such a system allows accurate diagnosis and the possibility of creating a data bank to describe the dynamic characteristics of the machine park. ESA

N88-15996*# Cleveland State Univ., Ohio.
HIGH TEMPERATURE TENSILE TESTING OF CERAMIC COMPOSITES Annual Report
John Z. Gyekenyesi and John H. Hemann Feb. 1988 46 p
(Grant NAG3-749)
(NASA-CR-180888; NAS 1.26:180888) Avail: NTIS HC A03/MF A01 CSCL 14B

The various components of a high temperature tensile testing system are evaluated. The objective is the high temperature tensile testing of SiC fiber reinforced reaction bonded Si3N4 specimens at test temperatures up to 1650 C (3000 F). Testing is to be conducted in inert gases and air. Gripping fixtures, specimen configurations, furnaces, optical strain measuring systems, and temperature measurement techniques are reviewed. Advantages and disadvantages of the various techniques are also noted. Author

N88-15997# Naval Postgraduate School, Monterey, Calif.
DESIGN OF A VELOCITY AND POSITION CONTROL LABORATORY SERVO SYSTEM M.S. Thesis
Michael A. Ziegler Sep. 1987 157 p
(AD-A186596) Avail: NTIS HC A08/MF A01 CSCL 10B

In support of a course in automatic control theory, a velocity and position control laboratory servo system was designed for use in laboratory exercises. The system is constructed using a commercially available DC motor and power amplifier, which are interfaced to a student control panel. All system changes and measurements are conducted with the control panel. The system can be operated open or closed loop, in a position or velocity control mode, and has several adjustable compensators incorporated in the signal path. This thesis provides detailed construction, wiring, and system testing steps, along with the required scale drawings, necessary to perform the hardware integration. A set of laboratory procedures, example laboratory reports, and advanced servo control problems are included for instructional purposes. GRA

N88-15795*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RESEARCH SENSORS
David R. Englund *In its* Aeropropulsion '87. Session 4: Instrumentation and Controls Research Nov. 1987 12 p
(For primary document see N88-15794 08-07)
Avail: NTIS HC A05/MF A01 CSCL 14B

N88-15935*# Analex Corp., Fairview Park, Ohio.
THERMAL ANALYSIS FOR THE CRYOGENIC FLUID MANAGEMENT FLIGHT EXPERIMENT (CFMFE)
George R. Smolak *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 221-239
(For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 14B

N88-15937*# McDonnell-Douglas Corp., St. Louis, Mo.
LOW-g PROPELLANT GAGING
George Orton *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 253-268
(For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 14B

N88-16039# Endevco, San Juan Capistrano, Calif.
ZEROSHIFT OF PIEZOELECTRIC ACCELEROMETERS IN PYROSHOCK MEASUREMENTS
Anthony Chu *In* Shock and Vibration Information Center The

Shock and Vibration Bulletin. Part 1: Welcome, Keynote Address, Invited Papers, Nondevelopment Items Workshop and Pyrotechnic Shock Workshop Jan. 1987 p 71-80 (For primary document see N88-16034 08-39)
Avail: NTIS HC A05/MF A01 CSCL 20K

N88-16114# Joint Publications Research Service, Arlington, Va.
MODELING OF ARCHITECTURE OF A PROBLEM-ORIENTED ON-BOARD PROCESSOR Abstract Only
M. A. Aliyeva, V. N. Vintayev, and K. Kh. Ismailov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 134 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 112-117 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16174# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
AN AUREOLAR RADIOMETER FOR THE DETERMINATION OF AEROSOL SIZE DISTRIBUTION [EIN AUREOLENRADIOMETER ZUR BESTIMMUNG DER AEROSOLGROESSENVERTEILUNG]
Dieter Rabus *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 189-192 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16224# Stockholm Observatory (Sweden).
A NEW LIQUID HELIUM-COOLED FABRY-PEROT SPECTROMETER USED IN A FAR INFRARED ASTRONOMICAL BALLOON EXPERIMENT
H. L. Nordh and S. G. Olofsson *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 151-155 (For primary document see N88-16201 08-46)
(Grants SWEDBSA-DR-21/85; SWEDBSA-DR-24/86)
Copyright Avail: NTIS HC A21/MF A01

N88-16231# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France). Service d'Aeronomie.
AN ADVANCED VISIBLE-UV SPECTROMETER FOR ATMOSPHERIC COMPOSITION MEASUREMENTS
J. P. Pommereau and F. Goutail *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 197-200 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

N88-16233*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.
ROCOZ-A (IMPROVED ROCKET LAUNCHED OZONE SENSOR) FOR MIDDLE ATMOSPHERE OZONE MEASUREMENTS
H. S. Lee (SM Systems and Research Corp., Landover, Md.) and C. L. Parsons *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 207-214 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01 CSCL 14B

N88-16234# Bonn Univ. (West Germany). Inst. fuer Physik.
TOTAL: A NEW INSTRUMENT TO STUDY TURBULENT PARAMETERS IN THE MESOSPHERE AND LOWER THERMOSPHERE
F. J. Luebken *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 215-218 (For primary document see N88-16201 08-46)
(Grant BMFT-01-OE-86-046)
Copyright Avail: NTIS HC A21/MF A01

N88-16240*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.
INSTRUMENTATION UTILISATION FOR RISK CONTROL IN SAFETY OPERATIONS
F. R. Swayer *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 241-245 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01 CSCL 14B

N88-16500# Joint Publications Research Service, Arlington, Va.
COMPARISON OF SENSITIVITY AND PRECISION OF HOLOGRAPHIC AND SPECKLE-INTERFEROMETRY METHODS WITH FOURIER-PLANE RECORDING Abstract Only
I. S. Klimenko, V. P. Ryabukho, and B. V. Feduleyev *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 32 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 61, no. 5, Nov. 1986 p 1118-1122 Previously announced as X87-74020 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.
For related information see also *76 Solid-State Physics.*

N88-15998# SRI International Corp., Menlo Park, Calif.
LOW-POWER PHOTOLYTICALLY PUMPED LASERS Final Report
I. Messing, D. C. Lorents, and D. J. Eckstrom Aug. 1987 71 p (Contract W-7405-eng-48)
(DE88-002448; UCRL-15954) Avail: NTIS HC A04/MF A01

We have carried out an extensive series of measurements of the time-resolved Xe2* emission spectra following optical pumping by a short-pulse F2 laser at 157.6 nm. Most measurements were performed using a gated Optical Multichannel Analyzer detector; we also made measurements using a scanning monochromator fitted with a photomultiplier and using a boxcar integrator for time resolution. The two sets of results agree well and show that both the singlet and triplet emission bands are broader than expected and have center wavelengths closer together than expected. Measurements were performed both at room temperature and at elevated (140 C) and reduced (-27 C) temperatures. The broad bandwidth of the individual spectral bands was unexpected and conflicted with a previous spectral measurement using optical pumping by the Xe2* resonance line from a microwave discharge lamp. Therefore, we also performed a series of spectral measurements using this type of optical pumping. We achieved good agreement with some previous results in the literature, but not with the result in question. We conclude that the present results are reliable. The results presented in this report provide the first definitive measurement of the individual excimer emissions from each of the Xe2(0 sub u+) and Xe2(1 sub u) states. From these measurements and the known g round state potential, we derived a 1 sub u poten tial that reproduces the emission band very well. However, the 1 sub u potential is in substantial disagreement with the recent 1 sub u potential derived by the Toronto group. DOE

N88-15999# Shanghai Inst. of Machine Building Technology (China).
LASER TRANSFORMATION HARDENING OF PRECISION V-SLIDE WAY
G. Zhang, Q. Yang, and Y. Wu 1986 12 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-144028; ISTIC-TR-C-000089) Avail: NTIS HC E03/MF E01 CSCL 20E

The results of the study of the application of laser transformation hardening (LTH) on the precision slide ways and some specimens of 20, 45, GCr15, 18Cr2Ni4WA, or other steels by a 1KW transverse CO2 laser are presented. It is concluded that the LTH can meet all the requirements, such as the case hardness, case depth, distortion allowance, wear resistance, and technical reproducibility of the slide way. Thereby, it is recommended as a substitute for the conventional heat treatments and the like; for 45 steel

(hardened and tempered), the relation of the resultant case depth (H) with the laser incident power (P) and the transverse speed (V) can be given by H varies as f(P,V), when the coating and the spot size remain the same; the LTH steel is characterized by rapid transformation. The LTH experiments on the top circle surface of the big grooved needle slide of knitting machines are presented. The results were found to be satisfactory. GRA

N88-16000# Research Inst. of National Defence, Linkoeping (Sweden).
FREQUENCY LOCKING OF TWO LASERS
Goeran Hansson Jun. 1987 53 p In SWEDISH; ENGLISH summary
(FOA-C-30456-3.1; ISSN-0347-3708; ETN-88-91404) Avail: NTIS HC A04/MF A01; Research Institute of National Defence, Stockholm, Sweden KR 50

In a laser radar using coherent detection the beam from the transmitting laser is mixed with the beam from a local oscillator laser. Good detection demands a constant frequency difference between the lasers. A system locking the frequency difference is described: the frequency of one of the lasers is adjusted by altering its cavity length. Detection of the frequency difference is made in two ways, depending on whether the transmitting laser is working in pulse modulated or continuous mode. An existing detection system was improved. A detection device for a continuous wave transmitter was developed. ESA

N88-16064# Joint Publications Research Service, Arlington, Va.
VLBI RESEARCH ON OH-MASER IN W33 Abstract Only
V. Ye. Velikhov, D. Graham, and P. Diamond *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 53 Transl. into ENGLISH from Pisma v Astronomicheskiy Zhurnal (Moscow, USSR), v. 13, no. 5, May 1987 p 399-405 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16497# Joint Publications Research Service, Arlington, Va.
FORMATION OF HIGH-COHERENCE RADIATION IN FREE-RUNNING MODE RUBY LASER FOR PULSE HOLOGRAPHY Abstract Only
S. D. Nikolayev and I. O. Starobogatov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 22 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 61, no. 5, Nov. 1986 p 1090-1095 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

37 MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

N88-16001# Academia Sinica, Shenyang (China). Inst. of Metal Research.
INVESTIGATION ON DIFFUSION REACTION BRAZING OF ALUMINIUM
Z. Feng, Y. Yi, Y. Xu, and L. Hou 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143368; ISTIC-TR-C-000055) Avail: NTIS HC E03/MF E01 CSCL 13H

The paper refers to the study of the condition, process and essence in forming a joint during diffusion reaction brazing of Al with Cu as an intermediate layer. Al-Cu eutectic liquid phase is formed first in local zones through contact and diffusion of Cu and Al base metal, even in the presence of rolled oxide films under vacuum diffusion reaction brazing with Cu intermediate layer, for 10 to 15 minutes at temperatures slightly higher than 548 deg C and pressures of 2kPa. As the liquid in the local zone reacts with Al and Cu, the liquid forms in the whole joint rapidly. Under the pressure of the diffusion reaction brazing, part of the liquid remains in the joint gap, and the remainder, which is squeezed out, spreads between the oxide film and metal along the surface of a brazed joint. During solidification, the two parts of liquid bond with the base metal and form a joint with curved fillet. Neither the break of oxide film nor the addition of an active element such as Mg is required in this process. It is very important to control the amount of Cu and the brazing temperature strictly during diffusion reaction brazing of Al and Cu as an intermediate layer. GRA

N88-16002# Research Inst. of Electric Welding Machines, Chengdu (China).
STUDY OF COMBINATION TYPE CO2 LASER WELDING SYSTEM
C. Peng, R. Zhang, J. Huang, N. Wu, and S. Wang 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143764; ISTIC-TR-C-000056) Avail: NTIS HC E03/MF E01 CSCL 13H

A type of 500 W grade combination carbon dioxide (CO2) laser welding system made-up of several lower power lasers is investigated. The principle and construction of the system, and also the behavior of the combinatory focused laser beam, are described. Some factors which influence the properties of focused combination laser beam are analyzed. By this system, miniature thin wall stainless steel parts can be welded precisely. The advantages of the system are long-term stability and high quality of weld, among other things like compact size and ease of fabrication. GRA

N88-16003# Changchun Inst. of Automobile (China). First Inst. of Automobile.
EXPERIMENTAL INVESTIGATION ON THE BENDING FATIGUE PERFORMANCE OF GAS CARBONITRIDED AND CARBURIZED GEARS
Z. Li, C. Chen, J. Xu, T. Li, and Z. Meng 1986 15 p Sponsored by Inst. of Scientific and Technical Information of China, Beijing
(PB87-147997; ISTIC-TR-C-000097) Avail: NTIS HC E03/MF E01 CSCL 13I

A control experimental method of the bending fatigue test for automobile transmission gears which were gas carbonitrided or gas carburized in a no-muffle continuous furnace is introduced as well as S-N curves obtained with the method. Effects of the case composition, improper constituents in the microstructure and the gradient of hardness along depth of the case upon the gear performance of the bending fatigue, were investigated. The experimental results, which showed that the bending fatigue strength and life of the gas carbonitrided gears were notably higher than those of carburized gears, offered the basis for the replacement of carburizing of automobile transmission gears in the no-muffle continuous furnace. GRA

N88-16004# Argonne National Lab., Ill.
SUBMERGED ARC FLUX WELDING WITH CaF2-CaO-SiO2 FLUXES: POSSIBLE ELECTROCHEMICAL EFFECTS ON WELD METAL
S. Shah, M. Blander, and J. E. Indacochea 1987 12 p Presented at the International Symposium on Molten Salts, Honolulu, Hawaii, 18 Oct. 1987 Prepared in cooperation with Illinois Univ., Chicago
(Contract W-31-109-eng-38)
(DE88-003107; CONF-8710214-1) Avail: NTIS HC A03/MF A01

Compositional changes of weld metal from welds made by submerged arc flux welding of steel using CaF2-CaO-SiO2 fluxes are consistent with an electrochemical mechanism in which the filler wire is anodically oxidized to form oxides and fluorides, and metals are cathodically deposited at the weld pool-flux interface. This speculative mechanism, if proven by further detailed studies, could make it possible to predict fluxes which will improve the quality of welds. DOE

N88-16005# United Kingdom Atomic Energy Authority, Harwell (England).
COMPOSITE/METAL JOINTING TECHNOLOGY FOR VEHICLE WEIGHT REDUCTION Summary Report

D. T. Livey and J. C. McCarthy 1986 21 p
(DE88-900228; EUR-10551) Avail: NTIS (US Sales Only) HC A03/MF A01

A comprehensive program of work was carried out on the development and validation of design procedures for adhesively bonded composite-metal joints. Two computer programs were developed for the design of tubular joints (e.g., driveshafts) and sheet-sheet joints (e.g., for bodywork) which take account of the extensive yielding of adhesives in the prediction of joint stresses. Associated materials, testing and assessment work was also undertaken including: (1) the determination of adhesive and joint mechanical properties required for the validation of the design stress analyses and to establish a materials data base for future use in joint design; (2) the development of test methods to provide more reliable and accurate data on adhesive properties; (3) evaluation of environmental durability and surface treatment combinations on joint components; (4) testing of full size component joints for drive shafts and hatchback doors for both static and fatigue loading and tests at temperature extremes; and (5) preliminary assessment of non-destructive testing techniques. DOE

N88-16006*# Texas A&M Univ., College Station. Turbomachinery Labs.
A COMPARISON OF EXPERIMENTAL AND THEORETICAL RESULTS FOR LABYRINTH GAS SEALS WITH HONEYCOMB STATORS M.S. Thesis
Lawrence Allen Hawkins Feb. 1988 150 p
(Grant NAG3-181)
(NASA-CR-182441; NAS 1.26:182441; TL-SEAL-2-88) Avail: NTIS HC A07/MF A01 CSCL 13I

Experimental results for the rotordynamic stiffness and damping coefficients of a labyrinth -rotor honeycomb-stator seal are presented. The coefficients are compared to the coefficients of a labyrinth-rotor smooth-stator seal having the same geometry. The coefficients are compared to analytical results from a two-control-volume compressible flow model. The experimental results show that the honeycomb stator configuration is more stable than the smooth stator configuration at low rotor speeds. At high rotor speeds and low clearance, the smooth stator seal is more stable. The theoretical model predicts the cross-coupled stiffness of the honeycomb stator seal correctly within 25 percent of measured values. The model provides accurate predictions of direct damping for large clearance seals. Overall, the model does not perform as well for low clearance seals as for high clearance seals. Author

N88-16007*# Texas A&M Univ., College Station. Turbomachinery Labs.
EXPERIMENTAL ROTORDYNAMIC COEFFICIENT RESULTS FOR HONEYCOMB SEALS
David A. Elrod and Dara W. Childs Jan. 1988 167 p
(Grant NAG3-181)
(NASA-CR-182440; NAS 1.26:182440; TRC-SEAL-1-88) Avail: NTIS HC A08/MF A01 CSCL 13I

Test results (leakage and rotordynamic coefficients) are presented for seven honeycomb-stator smooth-rotor seals. Tests were carried out with air at rotor speeds up to 16,000 cpm and supply pressures up to 8.2 bars. Test results for the seven seals are compared, and the most stable configuration is identified based on the whirl frequency ratio. Results from tests of a smooth-rotor/smooth-stator seal, a teeth-on-stator labyrinth seal, and the most stable honeycomb seal are compared. Author

N88-15802*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROTORCRAFT TRANSMISSION
John J. Coy *In its* Aeropropulsion '87. Session 5: Subsonic Propulsion Technology Nov. 1987 9 p (For primary document see N88-15800 08-07)
Avail: NTIS HC A08/MF A01 CSCL 13I

N88-15898# Byron Jackson Pumps, Etten-Leur (Netherlands).
ROTOR DYNAMIC BEHAVIOR OF CENTRIFUGAL PUMPS
J. J. Verhoeven and S. Gopalakrishnan (Byron Jackson Pumps, Long Beach, Calif.) *In* Vibration Inst., The Shock and Vibration Digest, Volume 20, No. 1 Jan. 1988 p 3-12 (For primary document see N88-15897 08-31)
Avail: NTIS HC A05/MF A01

N88-16057# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
THE EFFECTS OF ROTOR UNBALANCE ON THE VERTICAL RESPONSE OF A SOFT-MOUNTED BLOCK
B. M. Antkowiak, F. C. Nelson, and M. Nabovi-Noori (Worcester Polytechnic Inst., Mass.) *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 187-192 (For primary document see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 13I

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N88-16008# Ecole Centrale de Lyon (France). Lab. d'Electrotechnique.
NONDESTRUCTIVE CONTROL: MODELING OF ELECTRO-MAGNETIC PHENOMENA, DEFECT CHARACTERIZATION, AND SENSOR OPTIMIZATION Ph.D. Thesis [CONTROLE NON DESTRUCTIF: MODELISATION DES PHENOMENES ELECTROMAGNETIQUES, CARACTERISATION DES DEFAUTS ET OPTIMISATION DES CAPTEURS]
Hassan Mansir 1986 167 p In FRENCH; ENGLISH summary
Sponsored by the Centre Technique des Industries Mecaniques, and Societe HBS
(ECL-86-14; ETN-88-91625) Avail: NTIS HC A08/MF A01

Numerical methods are used to predict the variations of the electrical magnitudes of a sensor exposed to the perturbations induced by the presence of defects. The modeling of Eddy current sensor defect detection in flat or cylindrical specimens is developed. The parameters are identified and discussed. ESA

N88-16009# Vrije Universiteit, Amsterdam (Netherlands). Subfaculteit Wiskunde en Informatica.
RELIABILITY ISSUES IN DISTRIBUTED OPERATING SYSTEMS
A. S. Tanenbaum and R. vanRenesse Dec. 1986 12 p
(PB88-100870; IR-120) Avail: NTIS HC A03/MF A01 CSCL 14D

Distributed systems span a wide spectrum in the design space. In the paper the authors will look at the various kinds and discuss some of the reliability issues involved. The first half of the paper will concentrate on the causes of unreliability, illustrating them with general solutions and examples. Among the issues treated are interprocess communication, machine crashes, server redundancy, and data integrity. In the second half of the paper, one distributed operating system, Amoeba, will be examined to see how reliability issues have been handled in at least one real system, and how the pieces fit together. GRA

N88-16010# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
SOLID MECHANICS RESEARCH FOR QUANTITATIVE NON-DESTRUCTIVE EVALUATION Final Report
J. D. Achenbach Aug. 1987 20 p
(Contract N00014-85-G-0113)
(AD-A186599) Avail: NTIS HC A03/MF A01 CSCL 20K

Non-destructive evaluation (NDE) procedures play an important role in materials processing, as well as in subsequent material testing, product design, analysis of service life expectancy, manufacturing, and quality control of manufactured products. They

are also essential to on line monitoring of the integrity of structural elements and complex systems. Rational accept and reject criteria should be based on NDE tests. Critical safety, efficiency and operational features of large-scale structures depend on adequate NDE capabilities. Acoustic Emission, Dynamic Fracture, Materials and Transducer Characterization, Failure Mechanisms and Processes in Composites using Acoustic Emission, Flaw Characterization by Ultrasonic Scattering Methods, Experimental Research on Ultrasonic Scattering from Flaws, Elastic Wave Interactions with Partially Contacting Surfaces: Application to Fatigue Crack Characterization, Ultrasonic Nondestructive Evaluation, Microstructure, and Fracture Toughness Interrelations, Low Frequency Acoustic Microscopy, Ultrasonic NDE of Composites as Inhomogeneous Media, Non destructive Characterization of Damage in Graphite Epoxy Laminates are presented. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N88-16011*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
POSTBUCKLING OF LAMINATED ANISOTROPIC PANELS
Glenda L. Jeffrey Oct. 1987 183 p
(NASA-TM-100509; NAS 1.15:100509) Avail: NTIS HC A09/MF A01 CSCL 20K

A two-part study of the buckling and postbuckling of laminated anisotropic plates with bending-extensional coupling is presented. The first part involves the development and application of a modified Rayleigh-Ritz analysis technique. Modifications made to the classical technique can be grouped into three areas. First, known symmetries of anisotropic panels are exploited in the selection of approximation functions. Second, a reduced basis technique based on these same symmetries is applied in the linear range. Finally, geometric boundary conditions are enforced via an exterior penalty function approach, rather than relying on choice of approximation functions to satisfy these boundary conditions. Numerical results are presented for both the linear and nonlinear range, with additional studies made to determine the effect of variation in penalty parameter and number of basis vectors. In the second part, six panels possessing anisotropy and bending-extensional coupling are tested. Detailed comparisons are made between experiment and finite element results in order to gain insight into the postbuckling and failure characteristics of such panels. The panels are constructed using two different lamination sequences, and panels with three different aspect ratios were constructed for each lamination sequence. Author

N88-16012# Naval Research Lab., Washington, D.C.
THE RELATIONSHIP OF TENSILE SPECIMEN SIZE AND GEOMETRY EFFECTS TO UNIQUE CONSTITUTIVE PARAMETERS FOR DUCTILE MATERIALS
Peter Matic, George C. Kirby, III, and Mitchell I. Jolles 5 Oct. 1987 41 p
(AD-A186020; NRL-MR-5936) Avail: NTIS HC A03/MF A01 CSCL 11F

Straightforward reduction of tensile specimen load-displacement data to uniaxial true stress-true strain data valid at large deformations is not possible for ductile material specimens which exhibit necking. For applications such as fracture mechanics and metal forming processes, valid uniaxial true stress-true strain data is essential for the accurate analysis and prediction of deformations beyond those encountered at incipient necking. This investigation reports on the use of tensile speciment size and geometry effects to accurately and uniquely assess the uniaxial true stress-true strain curve. This is done for a ductile steel in the context of an incremental elastic plastic constitutive theory employing isotropic hardening and a von Mises yield function. Experimental load-displacement data, experimental full field deformation data and the corresponding finite element computational geometries and applied loads for tensile specimen length diameter ratios are known quantities. The uniaxial true stress-true strain curve parameters and treated as unknown quantities. Successive iteration on the solution curve resulted in successful correlation between the experimental data and computational predictions for all four specimens considered. GRA

N88-16013# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE NONLINEAR DYNAMIC RESPONSE OF AN ELASTIC-PLASTIC THIN PLATE UNDER IMPULSE LOADING
Xintian Wang, Shantao Hong, and Zhiyuan Weng 11 Jun. 1987 31 p Transl. into ENGLISH from Guti Lixue Xuebao (China), no. 3, Sep. 1985 p 281-295 Original language document was announced in IAA as A86-20169
(AD-A182147; AD-E900674; FTD-ID(RS)T-0404-87) Avail: NTIS HC A03/MF A01 CSCL 20K

The effects of the physical and geometrical nonlinearities in a thin plate are treated as equivalent body forces and equivalent loads. Using the concept of influence functions, a method for analyzing the thin plate problem with both kinds of nonlinear effects is presented. In theoretical analysis, the influence of plastic region which extends in depth is considered, and an incremental formula of plastic strain is derived by applying the incremental plastic theory. In the calculation of practical examples, the numerical solutions for nonlinear dynamic responses of an elastic-plastic thin plate are obtained for various hardening coefficients and different impact loads with all the results being quite regular. IAA

N88-16014# Academia Sinica, Beijing (China). Inst. of Mechanics.
STRESS STRAIN FIELDS AT CRACK TIP AND STRESS INTENSITY FACTORS IN REISSNER'S PLATE
C. Liu and Y. Li 1986 12 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-144945; ISTIC-TR-C-000040) Avail: NTIS HC E03/MF E01 CSCL 20K

By using Reissner's theory, a general solution for stress strain fields at crack tip in a bending cracked plate is obtained. Using the neartip expansions, the stress intensity factors in finite size plates for symmetric and anti-symmetric cases are calculated. GRA

N88-16015# Academia Sinica, Beijing (China). Inst. of Mechanics.
FULLY PLASTIC ANALYSIS OF MIXED MODE PLANE-STRAIN CRACK PROBLEMS
M. He 1986 14 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-144929; ISTIC-TR-C-000038) Avail: NTIS HC E03/MF E01 CSCL 20K

The fully plastic solution for a central crack in an infinite plate subject to a combined loading of mode I and II is given, using the modified energy principles. Based on the solution, an elastic-plastic mixed mode fracture criterion is suggested. Numerical results for the inclined crack show that the effect of the plastic deformation should be considered in the investigation of the mixed mode fracture criterion. The numerical results for the critical stress are compared with available experimental data. GRA

N88-16016# Changsha Inst. of Tech. (China).
NONLINEAR LINE-SPRING MODEL FOR SURFACE CRACK ANALYSIS WITH PARTICULAR REFERENCE TO WORK HARDENING MATERIALS
Y. Lu and J. Ning 1986 11 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-144838; ISTIC-TR-C-000042) Avail: NTIS HC E03/MF E01 CSCL 20K

This paper presents a nonlinear line-spring model for the elastic-plastic analysis of surface cracks with particular reference to the work hardening materials. For the cases of surface cracks commonly occurring in thin plates and cylindrical shells, the J-integrals are evaluated and the results compared with those derived earlier. GRA

N88-16017# Academia Sinica, Beijing (China). Inst. of Mechanics.
SCANNING FINITE ELEMENT CALCULATION METHOD
N. Liang 1986 10 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143442; ISTIC-TR-C-000008) Avail: NTIS HC E03/MF E01 CSCL 20K

A finite element calculation method, i.e., a scanning method, is proposed. The structure is divided into a number of small segments, each of which is bounded by two sectional surfaces containing a number of nodes. Sectional surfaces which contain regions of interest or which will be used as boundaries for further calculations are selected as main sectional surfaces. When displacements on more sectional surfaces are required and the storage capacity of the computer is not large enough, then further computations can be made for a region between two main sectional surfaces on which the displacements have already been obtained from the proceeding calculations. GRA

N88-16018# Dalian Inst. of Tech. (China). Research Inst. of Engineering Mechanics.
GENERALIZED DISPLACEMENT METHOD IN THE FINITE ELEMENT ANALYSIS OF INCOMPRESSIBLE MATERIAL
W. Zhong and X. Lee 1986 9 p Sponsored by Inst. of Scientific and Technical Information of China, Beijing
(PB87-143434; ISTIC-TR-C-000007) Avail: NTIS HC E03/MF E01 CSCL 20K

In the application of the finite element method to incompressible material stress analysis problems, the displacements of the mesh points are not independent of each other. In the paper, by the application of the topological analysis to the planar triangular mesh, the incompressibility condition which implies the kinematical constraints to the nodal displacements is satisfied beforehand in the plane strain problems. Furthermore, by means of the kinematical analysis, the global displacement vector of the whole system, in which the generalized displacements of individual nodes are assembled as components, includes no superfluous unknown displacement. It is found that considerable computational effort will be saved, and the illconditioning of the global matrix will entirely disappear as well. GRA

N88-16019# Nanjing Aeronautical Inst. (China).
FINITE ELEMENT METHOD WITH CONTINUOUS MASS ELEMENTS
A. Zhang and J. Lin 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143384; ISTIC-TR-C-000002) Avail: NTIS HC E03/MF E01 CSCL 20K

Some of the defects in the prevailing finite element method of assumed shape function to evaluate natural frequencies and mode shapes of the dynamic systems have been examined retrospectively. Then a double-tapered beam element has been taken as an example to illustrate the finite element method with continuous mass elements, and furthermore, for piecewise or chain structure the more convenient transfer matrix method has been presented. Finally, some influential numerical results of modal parameters of beams with uniform and linearly varying cross sections are given for comparison with the prevailing finite element method and from them conclusions are drawn. GRA

N88-16020# Qinghua Univ. (China).
DYNAMIC FINITE ELEMENT WITH DIAGONALIZED CONSISTENT MASS MATRIX AND ELASTIC-PLASTIC IMPACT CALCULATION
W. Chien 1986 12 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143376; ISTIC-TR-C-000001) Avail: NTIS HC E03/MF E01 CSCL 20K

A new quadratic form function for elastic-plastic impact problems is discussed. The quadratic form function possesses diagonalized consistent mass matrix, and nonvanishing effect of internal stress to the equations of motion. GRA

N88-16021# Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway). Div. of Structural Engineering.
EFFECTS OF FABRICATION ON THE FATIGUE CAPACITY OF WELDED STEEL STRUCTURES
T. Lassen and K. Engesvik 12 Feb. 1986 41 p Sponsored by Royal Norwegian Council for Scientific and Industrial Research, Oslo
(PB87-144226; STF71-A86009; ISBN-82-595-4241-2) Avail: NTIS HC E04/MF E04 CSCL 20K

The variability in weld geometry of transverse non-load carrying fillet welds was investigated. Data were obtained from a total of 50 specimens, fabricated according to normal practice in a yard engaged in the production of offshore steel structures. The significance of the weld toe geometry on the fatigue life of cruciform joints was verified by testing the specimens. Axial misalignment measurements were carried out on welded connections in two different module support frames. The effect of recorded eccentricities on fatigue life was estimated. GRA

N88-16022# Academia Sinica, Beijing (China). Inst. of Mechanics.
ELASTIC-PLASTIC FRACTURE INVESTIGATION ON STABLE CRACK GROWTH FOR PLANE STRESS
J. Xu, Y. Xue, and J. Han 1986 12 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-144820; ISTIC-TR-C-000043) Avail: NTIS HC E03/MF E01 CSCL 20K

The stable crack growth processes in aluminum alloy sheet specimens with a flat or inclined central crack, subjected to uniform tensile load, have been investigated. The relations between the tensile load and the amount of crack extension were obtained. The deformation field was measured by using the laser speckle and moire method. The finite element analysis based on the large elastic-plastic deformation equation has also been carried out. The criterion proposed to predict crack growth under mode condition is that the tensile strain at the crack tip reaches the maximum elongation of the material. The calculated results are in good agreement with the experimental data. GRA

N88-16023# Tsinghua Univ., Beijing (China). Dept. of Mechanical Engineering.
STUDY ON THE FRACTURE BEHAVIOR OF 9 PERCENT NI STEEL WELDED JOINT
H. Fang, Y. Yan, and Y. Su 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143863; ISTIC-TR-C-000066) Avail: NTIS HC E03/MF E01 CSCL 20K

By using a scanning electron microscope, stretched zone width (SZW) at the crack tip on a fracture specimen taken from a welded joint is directly measured and the features of fractured surfaces are observed. The results show that in the typical multiple-pass welded joints of 9 percent Ni steel, the most embrittled region is not the bond, but the subcritical HAZ in the vicinity of the weld root. The effect of austenitic deposited metal on the chemical oxygen demand value (delta m) of the bond is investigated by means of comparative tests. GRA

N88-16024# Luoyang Shipbuilding Material Research Inst. (China).
COMPUTATION OF THE TENSILE AND BENDING RESTRAINT INTENSITIES OF WELDED SPECIMENS BY FINITE ELEMENT METHOD
C. Zhang 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143798; ISTIC-TR-C-000059) Avail: NTIS HC E03/MF E01 CSCL 20K

A finite element method (FEM) for computing the restraint intensity of a weldment is introduced and compared with actual measurement methods. By using FEM, the tensile and bending restraint intensities of different welded assemblies are computed and compared. On the basis of these results, the actual significance of bending restraint intensity in estimating the restraint severity of a weldment is discussed. GRA

N88-16025# Northwestern Polytechnical Univ., Xian (China).
FRACTURE-RESISTANT CHARACTERISTICS OF MEDIUM-STRENGTH PLATES WITH REGARD TO THE INITIATION, STABLE AND UNSTABLE PROPAGATION OF SURFACE CRACKS
Z. Cui, R. Zhang, S. Zheng, S. Qi, and H. Tao 1986 12 p Sponsored by Institute of Scientific and Technical Information of China, Beijing Prepared in cooperation with Institute of Aeronautical Materials, Beijing, China
(PB87-144804; ISTIC-TR-C-000045) Avail: NTIS HC E03/MF E01 CSCL 20K

The fracture-resistant characteristics of 18CrNiWA and 40CrNiMoA steel plates of four thicknesses (8,10,12 and 14mm) have been investigated experimentally, including initiation, stable growth and unstable propagation of surface cracks, under elastic-plastic conditions. GRA

N88-16026# Tianjin Univ. (China).
CRACK OPENING DISPLACEMENT TEST IN TENSION
L. Huo 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143848; ISTIC-TR-C-000064) Avail: NTIS HC E03/MF E01 CSCL 20K

The Crack Opening Displacement (COD) in tension is investigated. Test results indicated that it is doubtful to use the COD criterion as a parameter to evaluate the safety of a welded structure. GRA

N88-16027# Ministry of Metallurgical Industry, Beijing (China). General Research Inst. of Building and Construction.
MIXED METHOD OF FINITE STRIP AND FINITE ELEMENT
P. Taihua 1986 6 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143467; ISTIC-TR-C-000010) Avail: NTIS HC E03/MF E01 CSCL 20K

The finite element method is the most effective and versatile tool of solution in structural analysis. However, the computation cost may be very expensive, and usually jumps by an order of magnitude when a more refined, higher dimensional analysis is required. For many structures having regular geometric shapes and simple boundary conditions, finite strip method can reduce the computational effort and core requirement. A mixed method applicable to structures such as coupled shear wall, folded plates, and cylindrical shell with openings, column supported silo, is presented. The part of a structure having regular geometric shape is divided into strips, and the part having irregular geometric shape is divided into elements. The proposed strip method can be considered as an extension of finite strip method to structure of irregular geometric shapes. The accuracy and versatility of the method are demonstrated by numerical examples. GRA

N88-16028# Jiaotong Univ., Shanghai (China).
STUDY OF THE TECHNIQUE OF STRESS DETERMINATION BY MEASURING MAGNETISM
H. Zhou, L. Cheng, and Z. Shi 1986 9 p Sponsored by Inst. of Scientific and Technical Information of China, Beijing
(PB87-143905; ISTIC-TR-C-000070) Avail: NTIS HC E03/MF E01 CSCL 20K

The basic principle of the technique of stress determination by measuring magnetism is briefly introduced. The complicated nonlinear relationship between magnetization current and plane stress in the test member obtained by experiment is discussed; and finally a method of setting up a current-stress equation of unique solution is presented. This makes it possible to apply the nondestructive technique to practical engineering measurement. GRA

N88-16029# South China Inst. of Tech., Guangzhou. Seismological Inst. of Guangdong Province.
SOLUTION IN VIBRATION PROBLEMS OF RECTANGULAR PLATES WITH SPLINE FUNCTION
D. Zhang and S. Luo 1986 12 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143459; ISTIC-TR-C-000009) Avail: NTIS HC E03/MF E01 CSCL 20K

The study of thin and thick plates in vibration problems by cubic B-spline basic function, together with the basic function which is derived from the solution of beam vibration differential equation, is presented. The method has many excellent features compared with the finite element method as well as finite strip method: the order of matrices is lesser, the programming is easier, and the results of computing are more accurate. GRA

N88-16030# Shanghai Design Inst. of Pharmaceutical Industry (China).
INTEGRAL EQUATION METHOD FOR THE ANALYSIS OF PLATES AND SHELLS
G. He, C. Lin, and J. Tang 1986 8 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-144788; ISTIC-TR-C-000100) Avail: NTIS HC E03/MF E01 CSCL 20K

An integral equation approach to the analysis of thin plates and thin shallow shells based on the boundary domain technique is presented. The kernel functions adopted are Green functions obtained from the fundamental solution of a circular clamped plate or that in the theory of infinite shallow shells. By this method, the elastoplastic analysis of thin plates can also be carried out by modifying the right hand side of the matrix equation to take into account the elastoplastic effects of the plate during loading. The main features of the present method are its higher efficiency, smaller amount of data input and more economy in computer storage and computer time required. Several numerical examples were worked out with main results given. GRA

N88-16031# Xian Jiaotong Univ. (China).
MODE 3 PROBLEMS OF DOUBLY-PERIODIC RHOMBIC AND RECTANGULAR ARRAY OF EQUAL CRACKS IN AN INFINITE PLATE
Z. Kuang, X. Li, and R. Fan 1986 10 p Prepared in cooperation with Xian Inst. of Highway (China), and Xianyang School of Agricultural Machinery (China). Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-144846; ISTIC-TR-C-000041) Avail: NTIS HC E03/MF E01 CSCL 20K

By using the Weierstrass elliptic function, the exact solutions of K III for the various doubly-periodic rhombic and rectangular arrays of equal cracks in various mode 3 problems were obtained. GRA

N88-16032# Xian Inst. of Metallurgy and Construction Engineering (China).
RESIDUAL STRESS EFFECT ON STABILITY OF AXIALLY LOADED COLUMNS
J. Chen 1986 9 p Sponsored by Institute of Scientific and Technical Information of China, Beijing
(PB87-143889; ISTIC-TR-C-000068) Avail: NTIS HC E03/MF E01 CSCL 20K

A method to determine the stability coefficient of an axially loaded column is presented. The equivalent relative eccentricity is used to take the effects of residual stresses into account. The stability coefficient of an imperfect column is obtained by considering the axially loaded column as an eccentrically loaded one with the equivalent relative eccentricity, initial end eccentricity, as well as out-of-straightness. GRA

N88-16033# Lawrence Livermore National Lab., Calif.
FAILURE MODES OF LAMINATE STRUCTURES

L. B. Gordon, R. L. Druce, and M. J. Wilson Jun. 1987 6 p Presented at the 6th Institute of Electrical and Electronic Engineers Pulsed Power Conference, Arlington, Va., 29 Jun. 1987 Prepared in cooperation with Auburn Univ., Ala.
(Contract W-7405-eng-48)
(DE88-002579; UCRL-96205; CONF-870656-48) Avail: NTIS HC A02

Laminate structures composed of alternating thin layers of conductor and dielectric material are commonly used in energy storage and transmission components. The failure of the dielectric layers in regions of high field stress, with applied 60 Hz ac, dc, and impulse voltages, was studied. Several geometries were compared, including staggered and flush edges. Electrical trees developed between the laminated dielectric layers. The visual characteristics and growth rates of the electrical trees under ac, dc, and impulse stresses were different. Partial discharge detection and analysis were used to measure the inception voltage and discharge activity at the conductor edge voids, to observe tree formation and growth, and to predict impending failure due to dielectric erosion. Electric field distributions were modeled and partial discharge inception levels were estimated from known void geometries. The staggered edge geometry appears to enhance the electric field stress at the recessed electrode. DOE

N88-16034# Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION BULLETIN. PART 1: WELCOME, KEYNOTE ADDRESS, INVITED PAPERS, NONDEVELOPMENT ITEMS WORKSHOP AND PYROTECHNIC SHOCK WORKSHOP Monthly Report
Jan. 1987 84 p Presented at the 57th Symposium on Shock and Vibration, New Orleans, La., 14-16 Oct. 1986
(AD-A186748; SVIC-Bull-57-Pt-1) Avail: NTIS HC A05/MF A01 CSCL 20K

The proceedings of the 57th Shock and Vibration Symposium are presented. In part 1 is presented the welcoming and the keynote address along with invited papers such as, Dynamic Testing - Seven Years Later. Papers from the Nondevelopment Items workshop such as, Guidelines for Qualifying Nondevelopment Equipment to Shock and Vibration, are presented. And from the Pyrotechnic Shock Workshop the paper entitled, Designing Electronics for Pyrotechnic Shock, is presented. For individual titles, see N88-16035 through N88-16039.

N88-16035# Hughes Aircraft Co., El Segundo, Calif.
DYNAMIC TESTING: SEVEN YEARS LATER
Allen J. Curtis *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 1: Welcome, Keynote Address, Invited Papers, Nondevelopment Items Workshop and Pyrotechnic Shock Workshop Jan. 1987 p 33-40 (For primary document see N88-16034 08-39)
Avail: NTIS HC A05/MF A01 CSCL 20K

The author briefly reviews developments in dynamic testing since a prior review in 1979. The gains addressed are: (1) Increased versatility of digital controllers to synthesize more realistic test conditions; (2) Issuance of MIL-STD-810D which legitimized test tailoring; (3) General acceptance of the need for broadband vibration screens; and (4) Maturing of the application of TAAF and CERT testing. E.R.

N88-16036# Boeing Aerospace Co., Seattle, Wash.
GUIDELINES FOR QUALIFYING NON-DEVELOPMENT EQUIPMENT TO SHOCK AND VIBRATION
Clark J. Beck, Jr. *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 1: Welcome, Keynote Address, Invited Papers, Nondevelopment Items Workshop and Pyrotechnic Shock Workshop Jan. 1987 p 41-45 (For primary document see N88-16034 08-39)
Avail: NTIS HC A05/MF A01 CSCL 20K

The equipment costs for new vehicles can be substantially reduced if available equipment is used, thereby saving development costs. Further cost reductions can be realized if shock and vibration qualification testing can be eliminated. Guidelines are presented for determining if a nondevelopment equipment item is suitable for use on a new vehicle without additional vibration and shock testing. These guidelines were successfully implemented on several programs. Using these guidelines, it was possible to reduce the number of tests on one program by 92 percent. Author

N88-16037# McDonnell-Douglas Corp., St. Louis, Mo.
DERIVATION OF EQUIPMENT VIBRATION REQUIREMENTS FOR AV-8B
Theodor H. Beier *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 1: Welcome, Keynote Address, Invited Papers, Nondevelopment Items Workshop and Pyrotechnic Shock Workshop Jan. 1987 p 59-65 (For primary document see N88-16034 08-39)
Avail: NTIS HC A05/MF A01 CSCL 20K

The method used to derive vibration test requirements for AV-8B equipment procurement is discussed. The reasons why a vectored-thrust, V/STOL aircraft requires unique considerations not covered in MIL-STD-810C or British Standard 3G.100 are indicated. An approach is offered for specification of vibration requirements which incorporates these V/STOL considerations, and which accommodates the test types of either standard to the extent possible. Author

N88-16038# TRW, Inc., Redondo Beach, Calif.
DESIGNING ELECTRONICS FOR PYROTECHNIC SHOCK
Henry Luhrs *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 1: Welcome, Keynote Address, Invited Papers, Nondevelopment Items Workshop and Pyrotechnic Shock Workshop Jan. 1987 p 67-70 (For primary document see N88-16034 08-39)
Avail: NTIS HC A05/MF A01 CSCL 20K

Comments made at a Pyrotechnic Shock work session are presented. Experience with testing and designing spacecraft electronic equipment for pyrotechnic shock are described. Author

N88-16039# Endevco, San Juan Capistrano, Calif.
ZEROSHIFT OF PIEZOELECTRIC ACCELEROMETERS IN PYROSHOCK MEASUREMENTS **c35**
Anthony Chu *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 1: Welcome, Keynote Address, Invited Papers, Nondevelopment Items Workshop and Pyrotechnic Shock Workshop Jan. 1987 p 71-80 (For primary document see N88-16034 08-39)
Avail: NTIS HC A05/MF A01 CSCL 20K

Zeroshift, a common measurement error in piezoelectric shock accelerometry, is any spurious output baseline shift which occurs after a pyroshock event. All components of the shock measurement system are analyzed for sources of zeroshift, and preventive practices are presented to aid in equipment selection, setup, and operation. Author

N88-16040# Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION BULLETIN. PART 3: ISOLATION AND DAMPING, VIBRATION TEST CRITERIA, AND VIBRATION ANALYSIS AND TEST Monthly Report
Jan. 1987 210 p Presented at the 57th Symposium on Shock and Vibration, New Orleans, La., 14-16 Oct. 1986
(AD-A186750; SVIC-Bull-57-Pt-3) Avail: NTIS HC A10/MF A01 CSCL 20K

Topics addressed include: shock isolation, damping tests; dynamic structural analysis; vibration simulation; vibration test criteria; inflight vibration and acoustic testing; and vibration analysis. For individual titles, see N88-16041 through N88-16058.

N88-16041# Westinghouse Electric Corp., Sunnyvale, Calif.
ON FREE DECAY DAMPING TESTS
L. K. H. Lu, R. Perez, and K. B. Schneider *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 1-7 (For primary document

see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

Measuring logarithmic acceleration response to a transient input is a relatively simple method used to estimate an average damping coefficient. The method is not limited by either high modal density or high damping values. However, the time decay curve obtained from these tests can be difficult to interpret because of either the presence of beating or of multiple decay slopes. The results of both predicting response of, and testing a simple rectangular plate with constrained layer damping treatment on one half of the plate with constrained layer damping treatment on one half of the plate are presented. The predicted results are based on both Statistical Energy Analysis (SEA) and Finite Element Analysis (FEA). It is found that simple SEA equations predict the dual slopes found in the time transient responses resonably well. Author

N88-16042# Concordia Univ., Montreal (Quebec). Dept. of Mechanical Engineering.
RESPONSE OF A SEQUENTIAL DAMPER TO SHOCK INPUTS
S. Rakheja and S. Sankar *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 9-15 Sponsored in part by Natural Sciences and Engineering Research Council of Canada (For primary document see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

Shock isolation performance of a shock mount consisting of a linear spring in parallel with a sequential damper is investigated. The sequential damper based on semi-active control offers a compromise between active and passive shock isolation systems. The sequential damper requires only minimal power to generate the command signal for modulating the orifice for fluid flow. Control schemes required to generate the command signal to achieve sequential modulation of the crifice are discussed. The shock isolation performance of the sequential damper is evaluated in terms of its acceleration, velocity, and relative displacement response due to shock excitations. The performance characteristics of the sequential damper are compared to the response characteristics of a shock isolator with passive damping to demonstrate the superior performance of the sequentially damped shock isolator. Author

N88-16043# BDM Corp., Albuquerque, N. Mex.
LIQUID SPRING DESIGN METHODOLOGY FOR SHOCK ISOLATION SYSTEM APPLICATIONS
Marek L. Winiarz *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 17-28 (For primary document see N88-16040 08-39) (Contract DACA45-86-D-0027)
Avail: NTIS HC A10/MF A01 CSCL 20K

Liquid springs are one of the less well known types of spring/damper systems available to the shock isolation system designer. Current liquid spring applications and characteristics are described and a simplified order-of-magnitude method for estimating size and weight of a liquid spring in any proposed application are provided. Author

N88-16044# Assurance Technology Corp., Carlisle, Mass.
DESIGN AND TEST OF A SPACECRAFT INSTRUMENT SHOCK ISOLATOR **c18**
D. Schiff, N. Jones, and S. Fox *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 29-45 (For primary document see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 22B

A shock isolator is required to protect the accelerometer in a satellite attitude control system against pyrotechnic shock. This shock isolator must also yield an acceptable response to the random vibration environment, maintain angular alignment within 0.25 degress of arc, and meet restrictive weight and volume requirements. The time available for design, fabrication, and test precluded the custom fabrication of elastomeric parts. After consideration of several design concepts, an approach was selected which utilizes commercially available O-rings as the springs for the shock isolator. The final design provided acceptable accelerations at the attitude control system when tested to the specified shock and vibration environments, and maintained angular alignment well within required limits. Author

N88-16045# Hong Kong Univ. Dept. of Civil and Structural Engineering.
DYNAMIC ANALYSIS OF A STRUCTURE WITH SLIDING BASE
T. C. Liauw, Q. L. Tian (Chinese Academy of Sciences, Peking.), and Y. K. Cheung *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 47-56 (For primary document see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

The vibration isolation technique of mounting a structure on a surface which permits sliding is studied. The periodic response of the structure with many degrees of freedom on a sliding base is calculated by the use of the Fourier series to represent the frictional force. The occurrence of subharmonic resonance frequencies is explained, and the prevention of these subharmonics is discussed with the support of a model test together with an analytical calculation. Lastly, a stochastic analysis for such a system is presented. Author

N88-16046# Ministry of Defence, Haifa (Israel). Armament Development Authority.
A MODAL CONTROL BASED LIMITING PERFORMANCE FORMULATION FOR SHOCK EXCITED SYSTEMS
Y. Narkis and W. D. Pilkey (Virginia Univ., Charlottesville.) *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 57-65 (For primary document see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

The limiting performance of shock isolation of multi-degree-of-freedom systems is studied by a combined modal analysis, modal control approach. The isolating elements are replaced by control forces, which are then approximated by a time series based on the natural frequencies of the system. Assuming that the equations of motion, the performance index, and the constraints are all linear, the optimizatin problem is formualted as one of linear programming. A two-degree-of-freedom example is solved to demonstrate the feasibility of the proposed method and its advantages over other methods. The modal analysis-modal control approach is then applied to the solution of the limiting performance problem of shock isolation of a cantilevered beam. Author

N88-16047# Ministry of Defence, Haifa (Israel). Armament Development Authority.
ANALYTICAL STUDY OF THE EFFECT OF EARLY WARNING ON OPTIMAL SHOCK ISOLATION
Y. Narkis and W. D. Pilkey (Virginia Univ., Charlottesville.) *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 67-72 (For primary document see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

The optimal shock isolation of a single degree-of-freedom system with early warning is accomplished by an active bang-bang control. It is shown that this problem can be solved analytically using a kinematic approach. For a typical shock input, the optimal control is found to consist of a main positive pulse, and possibly additional initial and terminal negative pulses. The existence of a maximum usable early warning time, beyond which there can be no further improvement in isolation, is identified. Author

N88-16048# Army Combat Systems Test Activity (Provisional), Aberdeen Proving Ground, Md.
TECOM'S RESEARCH EFFORTS IN THE DYNAMIC ENVIRONMENTS
John A. Robinson *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 73-87 (For primary document see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

The U.S. Army Test and Evaluation Command's Shock and Vibration Technical Committee is actively involved in research efforts in the dynamic environments associated with the transport of material in a wide variety of vehicles. The results of these efforts provide the technical community with vital and timely information for use in test tailoring. The results of the completed research are described as as the objective of the current and near-future research efforts. Author

N88-16049# Army Combat Systems Test Activity (Provisional), Aberdeen Proving Ground, Md.
THE DEVELOPMENT OF LABORATORY VIBRATION TEST SCHEDULES: PHILOSOPHIES AND TECHNIQUES
Richard D. Baily *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 89-101 (For primary document see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

The philosophies and techniques developed and used within the U.S. army Combat Systems test Activity (USACSTA) at the Aberdeen Proving Ground, Md, to derive laboratory vibration test schedules that simulate the field transportation vibration environment associated with tactical vehicles are described. The logical progression from acquiring data on a tactical vehicle over fixed-profile test courses through the analysis and manipulation of the data to the final laboratory schedule of amplitude, frequencies, and test times is covered. Author

N88-16050# Army Combat Systems Test Activity (Provisional), Aberdeen Proving Ground, Md.
LABORATORY VIBRATION TEST SCHEDULES DEVELOPMENT BEYOND MIL-STD-810D
Richard D. Baily *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 103-106 (For primary document see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

The documentation is listed and the work that was accomplished in deriving laboratory vibration test schedules for tactical vehilces since the introduction of such scedules in MIL-STD-810D are described. Approximately 20 schedules were developed from field data acquired on 15 different vehicles. Author

N88-16051# Sandia National Labs., Albuquerque, N. Mex.
ANALYSIS OF SHOCK AND VIBRATION ENVIRONMENTS FOR CARGO ON C9B TRANSPORT AIRCRAFT c05
Thomas J. Baca, James W. Doggett, and Clarence A. Davidson *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 133-146 (For primary document see N88-16040 08-39)
(Contract DE-AC04-76DP-00789)
Avail: NTIS HC A10/MF A01 CSCL 01C

The definition of shock and vibration environments on the floor of cargo aircraft is of prime importance to designers of hardware which must be transported. The DOE/DOD Environmental Data Bank maintains an extensive collection of environmental definitions for aircraft. The process involved in acquiring and analyzing shock and vibration data on the cargo floor of a C9B turbojet for incorporation into the Environmental Data Bank is described. The dual objectives are to show the procedure by which the environmental definition is created and to compare the results with existing definitions of shock and vibration environments on fixed-wing aircraft. Special emphasis is placed on instrumentation considerations which help ensure data integrity. Computerized data analysis techniques are described which greatly expedite the analysis of voluminous amounts of shock and vibration data stored on a computer data base system. Included in these analyses are auto-spectral density estimates, shock response spectra, and a relatively new shock characteristic called the shock intensity spectra. The resulting environment definition for cargo transport on the C9B aircraft was significant because it revealed frequency ranges in which the C9B shock and vibration environments exceeded levels seen on other military transport aircraft. Author

N88-16052# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
COMPREHENSIVE INFLIGHT VIBRATION AND ACOUSTIC TESTING c05
Phyllis G. Bolds *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 147-154 (For primary document see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 01C

The Air Force Flight Dynamics Laboratory has obtained inflight vibration and acoustic data on a series of operational aircraft for the upgrading of environment design criteria and verification of dynamic prediction techniques. The many uses of the data from the most recent comprehensive inflight survey, the F-111E aircraft, are presented. In addition to acquiring the dynamics data in a timely manner, cost effectiveness, analysis techniques derived, instrumentation developed, and the expertise gained make a survey of this type most attractive to the Air Force. Author

N88-16053# Northrop Corp., Hawthorne, Calif. Electronics Div.
EVALUATION OF VIBRATION SPECIFICATIONS FOR ACOUSTIC ENVIRONMENTS c71
L. T. Nguyen and G. J. Zeronian *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 155-158 (For primary document see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 20A

To properly design any structure, it is necessary to determine the effects of various environments, vibration, and shock on that surface. Usually the environment which has the worst effect will be used as the design criteria for comparison with the static (yield or ultimate) material allowables. Analyzing the same structure under all of the various environments can be time consuming and costly. A method was devised previously to allow for various environments to be compared to each other to select the highest load or acceleration producing environment. A technique which extends the above method and allows an additional environment, acoustic vibration, to be compared with sine, random vibration and shock environments is introduced. Furthermore, these techniques enable all dynamic environments to be added together so only a single stress analysis of the structure is needed for combined environments. Author

N88-16054# TRW Electronics and Defense Sector, Redondo Beach, Calif.
FATIGUE EFFECTS OF A SWEPT SINE TEST
A. E. Galef *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 159-163 (For primary document see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

There is considerable equipment in the field that was procured before the superiority of a random test over a sinusoidal tests was generally acknowledged. A procedure is developed which (based upon the usual simplifying assumptions) can be used in some cases to estimate the capability of equipment which was tested only by an exponential sine sweep to withstand more realistic environments. Author

N88-16055# Sandia National Labs., Albuquerque, N. Mex.
STATISTICAL MEASURES OF CLIPPED RANDOM SIGNALS
Thomas L. Paez and David O. Smallwood *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 165-177 (For primary document see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

It is shown that substantial and yet difficult to detect errors may occur if random data are clipped and then filtered. For Stationary random processes formulas are presented for the spectral density (power spectra) of the clipped and filtered random process in terms of the spectral density of the original random process, the clipping level, and the gain characteristics of the filter. A nonstationary random process that is formed by summing components, each of which is a stationary, band-limited random process modulated by a deterministic function of time, is also analyzed. Estimates of the mean square output (the clipped and filtered input) are given. Examples are given that illustrate the problem of difficult to detect errors for both stationary and nonstationary cases, An overload detector is suggested which could significantly reduce the probability of this error. Author

N88-16056# Florida Atlantic Univ., Boca Raton. Center for Acoustics and Vibrations.
FULLY TURBULENT INTERNAL FLOW EXCITATION OF PIPE SYSTEMS **c34**
J. M. Cuschieri, E. J. Richards, and S. E. Dunn *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 179-185 (For primary document see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 20D

The excitation of pipe systems due to the internal flow turbulence is examined. The response of a pipe structure excited by a fully turbulent internal flow is described in terms of a forcing function dependent on the turbulence pressure spectrum and the corresponding functions of the correlation areas, and the mechanical mobility of the pipe structure. The resulting form of the pipe response is examined for both air and water flow with comparisons being made to previously published analytical and experimental results. Author

N88-16057# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
THE EFFECTS OF ROTOR UNBALANCE ON THE VERTICAL RESPONSE OF A SOFT-MOUNTED BLOCK **c37**
B. M. Antkowiak, F. C. Nelson, and M. Nabovi-Noori (Worcester Polytechnic Inst., Mass.) *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 187-192 (For primary document see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 13I

Lagrangian dynamics is used to derive the equations of motion for two, overhung, unbalanced rotors attached to a rigid, soft-mounted block. Solution methods are established for the associated eigenvalue problem and for steady-state response. For a particular set of parameters, predictions are made for the critical speeds, the steady-state vertical block motion, the cross-talk between rotors, and the effect of rotor speed detuning. Author

N88-16058# Texas A&I Univ., Kingsville. Dept. of Civil and Mechanical Engineering.
INVESTIGATION OF VIBRATION PROBLEMS WITH HETERODYNE HOLOGRAPHIC INTERFEROMETER
Robert A. McLauchlan *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 193-210 (For primary document see N88-16040 08-39)
(Contract F49620-82-C-0035)
Avail: NTIS HC A10/MF A01 CSCL 20K

Consistently large mechanical/acoustic vibration induced RMS deviations in 10 inch beam wavefronts were measured with the AFWL/ARAA heterodyne holographic interferometer wavefront sensor (HET) system. These large wavefront surface measurement errors motivated an investigation of the sources of these mechanical/acoustic vibrations and work to eliminate/minimize their impact on the HET wavefront sensor performance. The measurement and analysis program is described. Author

N88-16059# Fraunhofer Inst. fuer Werkstoffmechanik, Freiburg (West Germany).
THE J-INTEGRAL CONCEPT FOR ELASTIC-PLASTIC MATERIAL BEHAVIOR
W. Schmitt and R. Kienzler Mar. 1987 23 p
(W-5/87; ETN-88-91464) Avail: NTIS HC A03/MF A01

A simple analytical extension of the J-integral which extends the J concept to materials described by an incremental theory of plasticity is presented. The stress work density replacing the strain energy density is load-history dependent. The J-integral may be made path independent by virtue of an additional volume integral and may be understood as work dissipation rate. Study of the consequences for the applicability of the J concept to describe fracture processes shows that validity criteria proposed in the standards are not sufficient to yield configuration-independent J-resistance curves. However, a possibility to assess structure-dependent resistance curves based on plastic-collapse considerations is outlined. ESA

N88-16060*# Photon Research Associates, Inc., Cambridge, Mass.
LARGE-ANGLE SLEWING MANEUVERS FOR FLEXIBLE SPACECRAFT Final Report
Hon M. Chun and James D. Turner Washington NASA Feb. 1988 88 p
(Contract NAS1-18098)
(NASA-CR-4123; CR-R-016; NAS 1.26:4123) Avail: NTIS HC A05/MF A01 CSCL 22B

A new class of closed-form solutions for finite-time linear-quadratic optimal control problems is presented. The solutions involve Potter's solution for the differential matrix Riccati equation, which assumes the form of a steady-state plus transient term. Illustrative examples are presented which show that the new solutions are more computationally efficient than alternative solutions based on the state transition matrix. As an application of the closed-form solutions, the neighboring extremal path problem is presented for a spacecraft retargeting maneuver where a perturbed plant with off-nominal boundary conditions now follows a neighboring optimal trajectory. The perturbation feedback approach is further applied to three-dimensional slewing maneuvers of large flexible spacecraft. For this problem, the nominal solution is the optimal three-dimensional rigid body slew. The perturbation feedback then limits the deviations from this nominal solution due to the flexible body effects. The use of frequency shaping in both the nominal and perturbation feedback formulations reduces the excitation of high-frequency unmodeled modes. A modified Kalman filter is presented for estimating the plant states. Author

N88-16061# Oak Ridge National Lab., Tenn.
SUMMARY OF HSST WIDE-PLATE CRACK-ARREST TESTS AND ANALYSES
D. J. Naus, B. R. Bass, J. Keeney-Walker, R. J. Fields, R. deWit, and S. R. Low, III 1987 25 p Presented at the 15th Water Reactor Safety Information Meeting, Gaithersburg, Md., 26 Oct. 1987 Prepared in cooperation with National Bureau of Standards, Washington, D.C.
(Contract DE-AC05-84OR-21400)
(DE88-002601; CONF-8710111-7) Avail: NTIS HC A03/MF A01

Eleven wide-plate crack-arrest tests have been completed to date, seven utilizing specimens fabricated from A533B class 1 material (WP-1 series), and four fabricated from a low upper-shelf base material (WP-2 series). With the exception of one test in the WP-1 series and two tests in the WP-2 series which utilized

152-mm-thick specimens, each test utilized a single-edge notched (SEN) plate specimen 1 by 1 by 0.1 m that was subjected to a linear thermal gradient along the plane of crack propagation. Test results exhibit an increase in crack-arrest toughness with temperature, with the rate of increase becoming greater as the temperature increases. When the wide-plate test results are combined with other large-specimen results (Japanese ESSO, thermal-shock experiments and pressurized-thermal-shock experiments), the data show a consistent trend in which the K/sub Ia/ data extends above the limit provided in ASME Section XI.
DOE

N88-16062# Los Alamos National Lab., N. Mex.
THEORY OF DEFORMATION. PART 1: KINEMATICS
J. K. Dienes Dec. 1987 51 p
(Contract W-7405-eng-36)
(DE88-003007; LA-11063-MS-Pt-1) Avail: NTIS HC A04/MF A01

The purpose of this report is to develop the kinematic basis for a theory of deformation of materials with defects. One specific objective is to derive clear concepts of strain, strain-rate, stress and stress rate, and to demonstrate some new relations between measures of these quantities. A related objective is to clarify the concepts of strain, strain rate and stretching, so that the principle of superposition of strain rates can be developed in a systematic way in subsequent reports. This principle allows us to compute deformations involving both plastic flow and fragmentation. The theory of large deformation is addressed in a systematic manner with the polar decomposition theorem as a starting point. Two sets of orthogonal axes are distinguished, space axes that are fixed in ambient space, and polar axes that are related to material deformation. It is shown that in elasticity, Piola stress is a measure in polar axes. In addition, a special approach to computing rates of tensor quantities, called polar rates, is derived from several viewpoints. This allows us to compute rates in a manner that accounts for material rotation in an exact way. One consequence of this is a simple relation between Signorini strain rate and stretching, the symmetric part of the velocity gradient. A second result is to show that the polar stress rate is the appropriate measure of rate of change of Cauchy stress, and that the more traditional stress rate of Zaremba, Jaumann, and Noll is only an approximation, valid at small strains. Examples are described for materials undergoing simple shear, vortex motion and torsion.
DOE

N88-15899# Institutul Politehnic din Bucharest, (Rumania). Catedra de Rezistenta Materialelor.
MODAL ANALYSIS USING FREQUENCY RESPONSE MEASUREMENT DATA
M. Rades *In* Vibration Inst., The Shock and Vibration Digest, Volume 20, No. 1 Jan. 1988 p 13-21 (For primary document see N88-15897 08-31)
Avail: NTIS HC A05/MF A01

42 GEOSCIENCES (GENERAL)

N88-16063# Joint Publications Research Service, Arlington, Va.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: SPACE
24 Nov. 1987 175 p Transl. into ENGLISH from various Russian articles
(JPRS-USP-87-006) Copyright Avail: NTIS HC A08/MF A01

Articles from Soviet books and journals on the overall subject of space are translated and presented. The report is divided into subject areas: Manned mission highlights; Space sciences; Interplanetary sciences; Life sciences; Space engineering; Space applications; and Space policy and administration. Selected titles from these subject areas are presented. For individual titles, see N88-16064 through N88-16118.

N88-16064# Joint Publications Research Service, Arlington, Va.
VLBI RESEARCH ON OH-MASER IN W33 Abstract Only c36
V. Ye. Velikhov, D. Graham, and P. Diamond *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 53 Transl. into ENGLISH from Pisma v Astronomicheskiy Zhurnal (Moscow, USSR), v. 13, no. 5, May 1987 p 399-405 (For primary document see N88-16063 08-42)
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The OH maser source W33 was studied at a frequency 1665 MHz. In the continuous radio emission there is an extended region surrounding the compact W33 MAIN, in which star formation transpires. In W33 there are several discrete IR sources coinciding with the youngest HII zones. There are two regions with intermediate velocities of 36 km/s (W33A) and 56 km/s (W33B). A detailed knowledge of the horizontal structure of W33A is necessary for research on star formation. W33A observations were made using interferometers during 1983 and 1984. The image was constructed using a model with free parameters on the assumption that the source consists of a minimum number of components with a Gaussian spatial brightness distribution and that emission of no more than two components is received in each spectral channel. The spectral measurements revealed that the source spectrum consists of overlapping details with widths of about 2 kHz. The emission of the spectral lines is determined by several spatially separated regions. A map was constructed showing that the source is highly elongated and consists of six components which can be divided into three groups. The spectrum obtained in observations corresponds to the computed spectrum of the model.
Author

N88-16065# Joint Publications Research Service, Arlington, Va.
OBSERVATIONS OF GAMMA BURSTS FROM GBS 0526-66 Abstract Only c93
S. V. Golenetskiy, R. L. Aptekar, Yu. A. Guryan, V. N. Ilinskiy, and Ye. P. Mazets *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 54 Transl. into ENGLISH from Pisma v Astronomicheskiy Zhurnal (Moscow, USSR), v. 13, no. 5, May 1987 p 406-413 (For primary document see N88-16063 08-42)
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The extraordinary gamma burst of 5 March 1979 continues to be studied in detail. The burst GB 790305 began with a short, very strong initial impulse with a hard radiation component and an annihilation line. The initial impulse was followed by pulsating radiation characteristic of an X-ray pulsar and having a relatively soft spectrum. The most probable explanation of burst structure would be rotation of a neutron star with a period 8 + or - 0.05 s. The object was observed repeatedly during the period 1979 to 1983. A burst source, GBS 0526-66, is a series of recurrent bursts. During 687 days of observations 16 repeated bursts were observed. The strongest and most prolonged repeated burst was registered on 27 Feb. 1982. The temporal structure and energy spectra of GB 820227a are discussed. In contrast to GB 790305, these recurring bursts have no initial impulse with a hard radiation component. This evidently indicates a significant difference in the mechanism of generation of GB 790305 and the recurrent bursts.
Author

N88-16066# Joint Publications Research Service, Arlington, Va.
FLARE DOUBLET: INTERPLANETARY AND GEOMAGNETIC EFFECTS Abstract Only c90
K. G. Ivanov, N. V. Mikerina, P. P. Pavlov, and A. F. Kharshiladze *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 55 Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow, USSR), v. 27, no. 2, Mar. - Apr. 1987 p 201-205 Original language document was announced in IAA as A87-42003 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

The interaction effects of flare magnetic clouds are examined for the single flare doublet of 10 August 1979. It is shown that radial acceleration and transverse displacement of the front cloud can occur as the result of the cloud collision. This can lead to the appearance of interplanetary and geomagnetic disturbances

near the Earth, a rapid arrival of the bow shock, and an anomalous configuration and relatively low instantaneous velocity of this shock. Author

N88-16067# Joint Publications Research Service, Arlington, Va.
TRAJECTORY SYNTHESIS OF IONOGRAMS IN PRESENCE OF ARTIFICIAL IONOSPHERIC INHOMOGENEITIES Abstract Only **c46**
N. P. Danilkin, D. S. Lukin, and V. I. Stasevich *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 56 Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow, USSR), v. 27, no. 2, Mar. - Apr. 1987 p 217-221 Original language document was announced in IAA as A87-42006 (For primary document see N88-16063 08-42)
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The present study examines the digital synthesis of complex ionograms formed in the presence of a large local disturbance of ionospheric electron density during active injection experiments. The dependence of the ionogram on various parameters of the irregularity is investigated, and the main types and characteristic features of the possible ionograms are determined. Also considered is the optimal positioning of an additional receiver for obtaining ionograms with maximum information content. E.R.

N88-16068# Joint Publications Research Service, Arlington, Va.
ELECTROSTATIC VLF EMISSION DETERMINED FROM ROCKET AND SATELLITE EXPERIMENTS Abstract Only **c32**
N. I. Izhovkina and S. A. Pulinets *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 57 Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow, USSR), v. 27, no. 2, Mar. - Apr. 1987 p 270-273 Original language document was announced in IAA as A87-42016 (For primary document see N88-16063 08-42)
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Rocket and satellite data on very low frequency (VLF) emission in the magnetosphere and ionosphere are examined. Increments of electrostatic VLF emission for the most stable part of the spectrum are calculated for the anisotropic (in velocity space) distribution of the plasma electron component. Resonances arising during the emission of the VLF waves are examined, and results of numerical calculations are presented. E.R.

N88-16069# Joint Publications Research Service, Arlington, Va.
MONITORING OF Pc3 PULSATIONS IN SOLAR WIND AND AT EARTH BY INTERPLANETARY MAGNETIC FIELD Abstract Only **c92**
O. V. Bolshakova, V. A. Troitskaya, and T. B. Rusakova *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 58 Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow, USSR), v. 27, no. 2, Mar. - Apr. 1987 p 345-346 Original language document was announced in IAA as A87-42038 (For primary document see N88-16063 08-42)
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A significant statistical difference is found in Pc3 pulsations observed before the bow shock front and on the Earth surface. The properties were found to conform only for pulsations on the Earth surface and waves excited in the solar wind in the subsolar region of the shock front in the 9 to 13 LT range. The linear dimensions of this region were determined and found to coincide with an extended region of diffuse ion generation on the shock front. Author

N88-16070# Joint Publications Research Service, Arlington, Va.
DIPOLE COMPONENT OF RELICT RADIATION DETERMINED FROM RELIKT EXPERIMENT DATA Abstract Only **c92**
I. A. Strukov, D. P. Skulachev, M. N. Boyarskiy, and A. N. Tkachev *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 59 Transl. into ENGLISH from Pisma v Astronomicheskiy Zhurnal (Moscow, USSR), v. 13, no. 3, Mar. 1987 p 163-166 Original language document was announced in IAA asA87-42955 (For primary document see N88-16063 08-42)
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The technique used to measure relic radiation dipole anisotropy in the Relic experiment is presented. The thermodynamic temperature of the dipole component was determined with 90 percent confidence; it is equal to 3.16 + or - 0.12 mK in the direction of alpha = 11 h 17 min + or - 10 min, delta = -7.5 deg + or - 2.5 deg. This corresponds to the rate of motion of an observer relative to the background of 350 + or - 15 km/s at a background temperature of 2.73 K. Author

N88-16071# Joint Publications Research Service, Arlington, Va.
NONEQUILIBRIUM IONIZATION OF PREGALACTIC PLASMA AND LESSENING OF RELIC RADIATION ANISOTROPY Abstract Only **c75**
P. D. Naselskiy and A. G. Polnarev *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 60 Transl. into ENGLISH from Pisma v Astronomicheskiy Zhurnal (Moscow, USSR), v. 13, no. 3, Mar. 1987 p 167-173 Original language document was announced in IAA as A87-42956 (For primary document see N88-16063 08-42)
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The decrease in the level of small scale anisotropy of relic radiation due to the nonequilibrium ionization of pregalactic plasma is calculated. Consideration is given to the case where the ionizers are primary black holes which evaporated long ago. Author

N88-16072# Joint Publications Research Service, Arlington, Va.
UNUSUALLY STRONG DENSITY DECREASE IN NEAR-EARTH INTERPLANETARY PLASMA AND MAGNETICALLY QUIET DAY AS EFFECTS OF ISOLATED SOLAR FLARE Abstract Only **c75**
K. G. Ivanov and N. V. Mikerina *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 61 Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow, USSR), v. 27, no. 1, Jan. - Feb. 1987 p 7-11 Original language document was announced in IAA as A87-34227 (For primary document see N88-16063 08-42)
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An unusually large (four orders of magnitude) variation of interplanetary plasma density was observed near the Earth after the isolated solar flare of 26 July 1979. The extremely low density value of 0.1 to 0.2/cu cm was observed together with decreases in plasma velocity and temperature. This variation is interpreted as the result of the successive passage of the Earth through a shock layer, a magnetic cloud, and the wake of the cloud in the interplanetary medium. A global quiet day was found to occur on Earth right after the geomagnetic disturbance as the result of the intense rarefaction of the interplanetary medium after the isolated flare. Author

N88-16073# Joint Publications Research Service, Arlington, Va.
SOLAR COSMIC RAY PROPAGATION IN HIGH-VELOCITY SOLAR WIND STREAM Abstract Only **c92**
Ye. V. Kolomeyets and V. N. Sevostyanov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 62 Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow, USSR), v. 27, no. 1, Jan. - Feb. 1987 p 12-17 (For primary document see N88-16063 08-42)
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A study was made of the propagation of solar cosmic rays (SCR) in the high velocity solar wind. This involved a comparison of SCR propagating in the event of 17 Dec. 1976, when corotating high velocity streams were observed, and the event of 3 Jun. 1967, when this phenomenon was not observed. The particle transfer equation was solved numerically for describing SCR propagation in these events. The equation for anisotropic diffusion of SCR, with allowance for convection and change in particle energy in interplanetary space, as well as the pertinent kinetic propagation equation, were solved numerically. These solutions and an analysis of experimental data were used in studying the influence of long lived solar wind streams on the propagation of fast protons generated in solar flares. The analysis suggests that in the solar wind structure there are well defined channels for the propagation of fast charged particles. Author

N88-16074# Joint Publications Research Service, Arlington, Va.
LONGITUDINAL VARIATIONS OF EQUATORIAL IONOSPHERE DETERMINED FROM INTERCOSMOS-19 ARTIFICIAL EARTH SATELLITE DATA Abstract Only **c46**
N. A. Kochenova *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 63 Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow, USSR), v. 27, no. 1, Jan. - Feb. 1987 p 142-144 Original language document was announced in IAA as A87-34255 (For primary document see N88-16063 08-42)
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The global pattern of the longitudinal variations of the equatorial anomaly is obtained on the basis of Intercosmos-19 data. These data show the presence of stable longitudinal variations of electron density in the F2 maximum at the magnetic equator and related longitudinal variations of the entire near equatorial ionosphere in the geomagnetic latitude range up to + or - 40 deg. The character of this relationship as well as the correlation with equatorial electrojet intensity leads to the conclusion that there exist stable longitudinal variations of vertical electrodynamic drift, which determine the longitudinal variations of the equatorial ionosphere. Author

N88-16075# Joint Publications Research Service, Arlington, Va.
LIMITATION OF SPACECRAFT ORBIT NEAR COLINEAR LIBRATION CENTER OF LIMITED ELLIPTICAL THREE BODY PROBLEM Abstract Only **c13**
P. Ye. Elyasberg and T. A. Timokhova *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 64 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 293, no. 1, Mar. 1987 p 55-58 Original language document was announced in IAA as A87-35840 (For primary document see N88-16063 08-42)
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The method of osculating parameters is used to obtain the integral orbit restrictedness condition around the colinear libration center in the restricted elliptical three body problem. It is shown that, if a restricted orbit exists, it can be found by solvig the equations of spacecraft motion under the above mentioned conditions. Author

N88-16076# Joint Publications Research Service, Arlington, Va.
ABSORPTION OF CYCLOTRON RADIATION IN SKIN LAYER IN ARAKS EXPERIMENT Abstract Only **c75**
N. I. Izhovkina, S. A. Pulinets, and Ye. P. Trushkina *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 65 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 216-222 Original language document was announced in IAA as A87-41737 (For primary document see N88-16063 08-42)
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Analytical and numerical calculations are presented for the heating of the plasma electrons during very low frequency (VLF) propagation in the skin layer (omega approx. equal to Omega sub e) in the Araks experiment. The experiment involved the injection of pulsed electron streams from a rocket into the ionosphere at an initial current of 0.5 A and initial energies of 27 and 15 keV. It is shown that VLF bursts in the pauses between the electron pulses could be connected with VLF wave decay in the nonisothermal plasma of the skin layer. Author

N88-16077# Joint Publications Research Service, Arlington, Va.
ELECTRODYNAMICS OF MIDNIGHT SECTOR OF AURORAL OVAL IN PERIOD OF SLIGHT DISTURBANCE Abstract Only **c46**
E. M. Dubinin, P. L. Izraylevich, A. K. Kuzmin, N. S. Niklayeva, I. M. Podgornyy, A. N. Zaytsev, and V. G. Petrov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 66 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 223-234 Original language document was announced in IAA as A87-41738 (For primary document see N88-16063 08-42)
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The Intercosmos Bulgaria-1300 satellite measured magnetic and electric fields, airglow, and precipitating particles near the midnight meridian. A three dimensional structure of field aligned currents was found to exist in the midnight sector of the auroral oval during quiet and slightly perturbed periods: (1) an intense current into the ionosphere in the near polar region; (2) an intense current from the ionosphere further toward the equator; and (3) in the low latitude part, a current into the ionosphere whose magnitude is substantially less than that of the first two currents and which is part of zone 2 of evening sector currents. Author

N88-16078# Joint Publications Research Service, Arlington, Va.
AREA OF REDUCED ELECTRON CONCENTRATION IN TERRESTRIAL PLASMASPHERE Abstract Only **c46**
V. P. Grigoreva and V. V. Pisareva *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 67 Transl. into ENGLISH from Kosmicheskiya Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 235-242 Original language document was announced in IAA as A87-41739 (For primary document see N88-16063 08-42)
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Prognoz-5 observations of natural noise in the plasmasphere in the Southern Hemisphere during Jan. to Jun. 1977 are examined. Regions of low electron density at night, in the morning, and in the evening were observed. The most extensive regions with low electron density were located in the region of the Brazilian magnetic anomaly and in the geographic latitude range from + or - 30 deg from the equator and in the longitude range from 100 to 240 deg E, as well as at latitudes near the geomagnetic equator and in regions slightly displaced from this equator toward the winter hemisphere. Author

N88-16079# Joint Publications Research Service, Arlington, Va.
FLUCTUATIONS IN FREQUENCY OF COHERENT RADIO SIGNALS IN SOLAR PLASMA ACCORDING TO VENERA-15 AND VENERA-16 DATA Abstract Only **c32**
N. A. Savich, S. L. Azarkh, A. S. Vyshlov, A. L. Gavrik, N. V. Laptev, and A. S. Nabatov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 68 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 243-250 Original language document was announced in IAA as A87-41740 (For primary document see N88-16063 08-42)
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Frequency difference fluctuations of coherent radio signals (32 and 8 cm) scattered by the circumsolar plasma were measured by dispersion interferometry during May to July 1984. Standard deviations of the fluctuations decrease with increasing averaging time according to a power law and increase with approach to the Sun as exponent beta = -1.9. A regular shift of the frequency difference due to the motion of the radio beam with respect to the Sun was observed. The spatial spectrum of plasma turbulence was close to the Kolmogoroff-Obukhov spectrum for frequencies between 0.004 and 0.2 Hz. Author

N88-16080# Joint Publications Research Service, Arlington, Va.
DYNAMICS AND TURBULENCE OF SOLAR WIND IN AREA OF ITS FORMATION BASED ON RADIO TRANSMISSION DATA MEASURED WITH VENERA-15 AND VENERA-16 SPACECRAFT Abstract Only **c92**
O. I. Yakovlev, A. I. Yefimov, and S. N. Rubtsov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 69 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 251-257 (For primary document see N88-16063 08-42)
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Results are presented from radio transmission through the plasma near the Sun at centimeter and decimeter wavelengths conducted by the Venera 15 and Venera 16 spacecraft orbiting Venus in Mar. to Sep. 1984 during a period of moderate solar activity. The spacecraft transmitted coherent radio signals at 32 cm and 5 cm wavelength toward the Earth as Venus passed behind the Sun. The velocity of the solar wind was determined

for distances of 5.5 to 100 solar radii. At 10 to 25 solar radii there is a regular singular area in which the parameters of the solar wind change sharply. The relationship between the spectral index and velocity of the heterogeneous plasma is investigated. The variation in corona expansion velocity as a function of solar activity is discussed. Author

N88-16081# Joint Publications Research Service, Arlington, Va.
PERIODIC ORBITS OF LIMITED ELLIPTICAL THREE BODY PROBLEM Abstract Only **c13**
V. P. Yevteyev *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 70 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 321-323 (For primary document see N88-16063 08-42)
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A study was made of the problem of existence of periodic orbits in the immediate vicinity of the colinear libration points in the planar version of the elliptical three body problem. It is found that there are 2 pi/gamma-periodic solutions for libration points L sub 3. Conditions are outlined under which other periodic solutions appear, resulting in the theorem that in the immediate vicinity of libration point L sub 3, the equation describing the motion in the problem has periodic solutions with periods T = 2 pi k, where k = 1,2,3,..., and the solutions are described in the form of a series which converges absolutely. Author

N88-16082# Joint Publications Research Service, Arlington, Va.
HOLES IN OI 130 nm EMISSION FIELDS OF UPPER ATMOSPHERE DURING DAY Abstract Only **c46**
V. I. Krasovskiy and A. I. Semenov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 71 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 323-324 (For primary document see N88-16063 08-42)
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A review of photographs showing holes in the OI 130 nm emission fields of the terrestrial daytime upper atmosphere published by L. A. Frank, et al., reveals a multitude of holes of less contrast than those which the authors described and attributed to an influx of small comets into the Earth's upper atmosphere. All of the holes taken together form the nodes of a grid structure created by wave fronts mixing at an angle, well known from photographs of clouds and emission fields in the upper atmosphere. The waves may be ordinary sonic, internal gravitational and gamma waves, or shock waves from the polar auroras. Author

N88-16083# Joint Publications Research Service, Arlington, Va.
QUASIPERIODIC VARIATIONS IN MANIFESTATIONS OF SOLAR ACTIVITY Abstract Only **c92**
V. G. Mitrikas, V. M. Petrov, V. P. Okhlovkov, L. S. Okhlopkova, T. N. Charazhyan, and M. V. Zil *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 72 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 325-328 Original language document was announced in IAA as A87-41749 (For primary document see N88-16063 08-42)
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A spectral time series analysis for the 20th and 21st solar cycles shows that the variations of various geoheliophysical characteristics have three basic periods less than 11 years; approx. two years, approx. one year, and approx. five months; the quasi-biennial variations are the most intense. Variations of the frequency of solar proton events and galactic cosmic rays are basically in counterphase. The period of quasi-biennial variations in the 21st cycle is shorter than that in the 20th cycle. Author

N88-16084# Joint Publications Research Service, Arlington, Va.
SOLAR EVENT OF 27 APRIL 1981 Abstract Only **c92**
N. N. Volodichev, B. M. Kuzhevskiy, and O. Yu. Nechayev *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 73 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 329-331 (For primary document see N88-16063 08-42)
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The solar flare of 27 April 1981 had a duration of about 20 minutes and a total flux of gamma quanta in the 4 to 7 MeV band of about 100 protons per square centimeter. Continuous gamma radiation in the 0.29 to 1 MeV band, hard X-radiation and microwave radiation were also recorded, their time characteristics indicating that electrons and protons were accelerated to high energies practically simultaneously. A figure is presented illustrating the results of measurement of protons at 14 to 25 MeV by the IMP-8 satellite, equal to or greater than 100 and equal to or greater than 500 MeV by the Prognoz-8 satellite and other types of electromagnetic radiation. The event of 27 April 1981 is compared with the event of 4 August 1972, of comparable length and intensity. Author

N88-16085# Joint Publications Research Service, Arlington, Va.
APPLICATION OF CORRELATION METHOD OF RECEPTION OF DIRECT AND REFLECTED COSMIC RADIATION TO STUDY OF PLASMASPHERES OF PLANET AND DISTRIBUTION OF RADIATION BRIGHTNESS Abstract Only **c91**
D. Ya. Shtern and Ye. A. Garova *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 74 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 332-334 (For primary document see N88-16063 08-42)
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An analysis is presented of reception of a mixture of direct and reflected low frequency background cosmic radiation by an autocorrelation method. The analysis is applied to investigation of the plasmaspheres of the Moon and the planets, as well as the distribution of radiation brightness over the celestial sphere. Correlation processing of the direct and reflected low frequency background cosmic radiation signals received by spacecraft orbiting the Moon or planets can be used to determine the distribution of electron concentration in the plasma in the upper ionosphere and to study the distribution of the brightness of the low frequency background over the celestial sphere. Author

N88-16086# Joint Publications Research Service, Arlington, Va.
COMPARATIVE ANALYSIS OF ULTRAVIOLET OBSERVATIONS OF HALLEY'S COMET ON ASTRON ASTROPHYSICAL STATION BEFORE AND AFTER PERIHELION Abstract Only **c91**
A. A. Boyarchuk, V. P. Grinin, A. M. Zvereva, and A. I. Sheykhet *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 76 Transl. into ENGLISH from Pisma v Astronomicheskiy Zhurnal (Moscow, USSR), v. 13, no. 3, Mar. 1987 p 228-236 Original language document was announced in IAA as A87-42966 (For primary document see N88-16063 08-42)
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Spectrophotometric observations of Halley's comet were made in Dec. 1985 using the UV telescope on the ASTRON station. Important conclusions could be drawn using more than 100 spectra of the comet at different distances from the nucleus and three photometric sections of the peripheral parts of the coma in the band OH (O-O) 3085 A. There is a thermal inertia of the nucleus; its temperature and rate of sublimation of molecules from a unit surface prior to perihelion is lower than at the same heliocentric distances after perihelion. Other factors may also be responsible: a change in nucleus reflectivity after passage through perihelion and differences in its orientation relative to the Sun before and after perihelion. Since during one transit the nucleus radius decreases by only about 1.5 m, some explanation must be found for the great photometric effect observed from transit to transit. The only possible explanation for the brightness reduction is a decrease in nucleus albedo as a result of degradation of its surface, with accumulation of large dust particles and the formation of stable mineral crust. Author

N88-16087# Joint Publications Research Service, Arlington, Va.
MECHANISMS OF CLOUD LAYER FORMATION IN VENUSIAN ATMOSPHERE Abstract Only **c91**

Yu. V. Zhulanov, L. M. Mukhin, and D. F. Nenarokov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 77 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 295, no. 2, Jul. 1987 p 330-334 Original language document was announced in IAA as A87-51045 (For primary document see N88-16063 08-42)
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Data on the aerosol component of the Venus atmosphere obtained on the nightside of the planet by the Vega 1 and 2 probes on 11 and 15 June 1985 are discussed. The data indicate that the cloud system of the Venus atmosphere on the nightside can be viewed as a thick layer of photochemical haze at altitudes of 46 to 60 km. At altitudes of 56 to 60 and 46.5 to 49.5 km, thick layers (tiers) were observed which form due to the coarsening of primary nuclei. Author

N88-16088# Joint Publications Research Service, Arlington, Va.
ATMOSPHERE OF VENUS IN SOUTHERN POLAR AREA Abstract Only c91
O. I. Yakovlev, V. N. Gubenko, S. S. Matyugov, G. D. Yakovleva, and I. R. Vaganov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 78 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 258-266 Original language document was announced in IAA as A87-41742 (For primary document see N88-16063 08-42)
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An analysis is made of Venera 15 and 16 radio occultation data on the Venus atmosphere at heights of 40 to 90 km in the -60 to -76 deg latitude region at solar zenith angles of 65 to 118 deg. The height dependences of temperature, pressure, and density are presented. The large scale structure of the atmosphere in the southern polar region is found to be analogous to the structure of the atmosphere in the northern polar region. Author

N88-16089# Joint Publications Research Service, Arlington, Va.
ATMOSPHERE OF VENUS IN SOUTH POLAR AREA BASED ON RADIO TRANSMISSION DATA Abstract Only c91
O. I. Yakovlev, V. N. Gubenko, S. S. Matgov, and G. D. Yakovleva *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 79 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 267-274 Original language document was announced in IAA as A87-41743 (For primary document see N88-16063 08-42)
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Venera 15 and 16 radio occultation data on the Venus atmosphere is examined for six regions of the southern polar region. The investigation covers atmospheric heights of 50 to 90 km in the -82 to -89 deg latitude region at solar zenith angles of 82 to 91 deg. Dependences of temperature, pressure, and density on height are also examined. The atmospheric parameters in the southern and northern polar regions are compared. Author

N88-16090# Joint Publications Research Service, Arlington, Va.
ATMOSPHERE OF VENUS IN NORTH POLAR AREA BASED ON RADIO TRANSMISSION DATA FROM VENERA-15 AND VENERA-16 SPACECRAFT Abstract Only c91
O. I. Yakovlev, S. S. Matgov, A. I. Yefimov, V. N. Gubenko, A. I. Kucheryavenkov, A. S. Vyshlov, and G. D. Yakovleva *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 80 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 275-284 (For primary document see N88-16063 08-42)
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The history of Soviet and American radio transmission studies of the Venusian atmosphere is briefly outlined. Results are presented from studies of the atmosphere in the North polar area, analyzing changes in the status of the atmosphere at 40 to 90 altitude, 81 to 89 deg latitude, 81 to 95 deg solar zenith angles, from 14 to 31 October 1983. Nine regions in the Northern Hemisphere of the planet are covered. Author

N88-16091# Joint Publications Research Service, Arlington, Va.
PECULIARITIES OF DAYTIME IONOSPHERE OF VENUS DURING YEARS OF LOW AND HIGH SOLAR ACTIVITY Abstract Only c91
A. L. Gavrik and L. N. Samoznayev *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 81 Transl. into ENGLISH from Kosmicheskiya Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 285-291 Original language document was announced in IAA as A87-41745 (For primary document see N88-16063 08-42)
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Venera 15 and 16 two frequency radio occultation measurements carried out in 1983 to 1984 were used to determine the characteristics of the dayside atmosphere of Venus for intermediate states of solar activity. A comparison of these data with Venera 9 and 10 and Pioneer-Venus data revealed a series of ionospheric characteristics connected with the phase of the solar cycle. Author

N88-16092# Joint Publications Research Service, Arlington, Va.
DISTRIBUTION OF ELECTRON CONCENTRATION IN NIGHTIME ATMOSPHERE OF VENUS BASED ON RADIO TRANSMISSION DATA Abstract Only c91
I. K. Osmolovskiy and L. N. Samoznayev *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 82 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 292-300 (For primary document see N88-16063 08-42)
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Some new results are presented, obtained from the Venera 15 and 16 spacecraft, and all information available at the present on the altitude profiles of the electron concentration on the night side of the planet Venus are analyzed. The comparative analysis determined slow variations in the characteristics of the nighttime Venusian ionosphere related to the phase of the 11 year solar activity cycle. The ionosphere is found to vary greatly with both location and time. The characteristics of altitude profiles of electron concentration change with the phase of the solar activity cycle. The mean value of electron concentration at the maximum of the main nighttime Venusian ionosphere layer is 30 to 70 percent greater during periods of maximum solar activity than during periods of low activity. An extensive plasma envelope extending to about 1,000 km is located above the main ionospheric layer during the years of high solar activity. This plasma tail is not observed during the years of low activity. Author

N88-16093# Joint Publications Research Service, Arlington, Va.
APPLICABILITY OF EXTREMELY LOW FREQUENCY GLOBAL RESONANCES FOR STUDY OF VENUSIAN STORM ACTIVITY Abstract Only c91
A. P. Nikolayenko and L. M. Rabinovich *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 83 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 301-306 Original language document was announced in IAA as A87-41747 (For primary document see N88-16063 08-42)
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The applicability to Venus of an extremely low frequency (ELF) technique used on Earth to study global lightning activity is examined. A generalizing model of the lower Venusian ionosphere is used to calculate ELF electromagnetic fields. It is shown that observations of global resonances on Venus should make it possible to obtain information about the spatial temporal global distribution of lightning discharges and to improve the parameter values of the lower ionosphere model. Author

N88-16094# Joint Publications Research Service, Arlington, Va.
MAGNETIC FIELD OF PLANET URANUS: PREDICTIONS, MEASUREMENTS, INTERPRETATIONS Abstract Only c91
Sh. Sh. Dolginov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 84 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 307-320 Original language document was

announced in IAA as A87-41748 (For primary document see N88-16063 08-42)
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The magnitude and inclination of the eccentric dipole of Uranus are examined in the framework of the precession-dynamo model. It is shown that the unique parameters of the Uranus magnetic field are connected with the fact that this field is generated in two adjacent high conductivity regions of different density: the core with a mean density of 12 g/cu cm and the ocean with a mean density of 3.1 g/cu cm. The upper boundary of the magnetically active region in the ocean is determined by a magnetic pressure of 1.9 Mbar, at which the ocean matter is metallized. The dipole and quadrupole components of the Uranus field are calculated assuming that they are generated upon precession of the planet, primarily under the influence of the gravitational field of the satellite Miranda. Author

N88-16095# Joint Publications Research Service, Arlington, Va.
DISCOVERY BY VOYAGER-2 OF PREDICTED SATELLITES WHICH DETERMINE RESONANCE NATURE OF URANIAN RINGS Abstract Only **c91**
N. N. Gorkavyy and A. M. Fridman *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 85 Transl. into ENGLISH from Pisma v Astronomicheskiy Zhurnal (Moscow, USSR), v. 13, no. 3, Mar. 1987 p 237-244 Original language document was announced in IAA as A87-42967 (For primary document see N88-16063 08-42)
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Voyager 2 data have fully confirmed the hypothesis that Uranus rings are resonant in nature and that their locations are determined by the 1:2, 2:3, and 3:4 resonances from unknown satellites. Voyager 2 discovered a number of small satellites beyond the external boundary of the rings. The orbital radii of the four new satellites (the resonance effect of each of which determines the location of two rings) agree with predicted values. Author

N88-16096# Joint Publications Research Service, Arlington, Va.
SPACE BIOLOGY AND MEDICINE **c51**
A. I. Grigoryev *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 86-94 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 34-39 (For primary document see N88-16063 08-42)
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Medical and biological research has always assumed an important role in the space program. The number of experiments has grown with the emergence of manned missions. The work performed in the Intercosmos program represents a qualitatively new phase in the development of a space medicine and biology. The development of space medicine and biology is traced and some future experiments suggested. E.R.

N88-16097# Joint Publications Research Service, Arlington, Va.
RESULTS OF RESEARCH WITH BIOLOGICAL SATELLITES Abstract Only **c51**
G. Lomanov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 95 Transl. into ENGLISH from Sotsialisticheskaya Industriya (Moscow, USSR), 18 Sep. 1987 p 4 (For primary document see N88-16063 08-42)
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Some of the important results of research which has been conducted with biological satellites over the last 15 years is reviewed. In particular, weightlessness has been found to produce no destructive effects on tissues, intracellular processes and the principal systems of an organism. This means that space missions lasting as long as a year can now be authorized. With the aid of biological satellites, radiation safety norms have been substantiated, radiation monitors for manned spacecraft have been tested, and studies of the locomotion system have been conducted. These studies have led to development of a system of measures and physical exercises for preventing atrophy of groups of muscles that are not exerted in zero gravity, as well as loss of calcium from bone tissue. Author

N88-16098# Joint Publications Research Service, Arlington, Va.
RESEARCH ON COTTON PLANTS GROWN IN SPACE **c51**
In its JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 98 Transl. into ENGLISH from Pravda Vostoka (Tashkent, USSR), 22 Jul. 1987 p 3 (For primary document see N88-16063 08-42)
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Twenty cotton plant seedlings that had been planted in space were germinated. Some of these second generation plants were prepared to return to space. Two experiments for growing seeds in orbit proved unsuccessful. In the next experiment the cosmonauts breathed on the seedlings, and specially watered them, and the first green leaves appeared while the mission was in progress. Cotton thus became the third agricultural crop to sprout onboard a Soviet spaceship. Experiments are now continuing to determine the effects of zero gravity and other conditions of space flight affecting the cellular level and hereditary apparatus of the cotton plants. Interesting changes in fiber lengths are now being observed in one of the plants. E.R.

N88-16099# Joint Publications Research Service, Arlington, Va.
GYROSTABILIZER SYSTEM OF KVANT MODULE **c18**
N. Sheremetyevskiy and B. Chertok *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 99-100 Transl. into ENGLISH from Pravda (Moscow, USSR), 6 Sep. 1987 p 3 (For primary document see N88-16063 08-42)
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The development and features of the system used to control the rotary motion of the space complex, Mir, and orient it precisely during astronomical observations with equipment of the Kvant module are examined. This system allows the complex to be stabilized with a precision of one minute of arc. The system is said to include high precision angular velocity meters, inertial sensors of angular position, an onboard computer complex with a modular structure, and powered gyroscopes (gyrodynes on a magnetic suspension) which function as drive motors. Development of gyrodynes for the Kvant module involved mathematical modeling of electromagnetic, dynamic and thermal processes. Mathematical modeling also indicated the necessity of a special system of spatial arrangement for six gyrodynes on the module and was used to prepare highly complex algorithms for the control system's computer. These algorithms take into account maintenance of the system's controllability in any type of orientation of the Mir complex, and also while the gyrodynes are being put into their initial state, using only a gravitational system which conserves power sources. Author

N88-16100# Joint Publications Research Service, Arlington, Va.
SINGLE-BURN TRANSFER TO NOMINALLY PERIODIC ORBIT IN THE VICINITY OF POINT L2 OF EARTH-SUN SYSTEM AND RELATED PROBLEMS Abstract Only **c13**
M. L. Lidov, V. A. Lyakhova, and N. M. Teslenko *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 103 Transl. into ENGLISH from Kosmicheskiya Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 163-185 Original language document was announced in IAA as A87-41733 (For primary document see N88-16063 08-42)
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Computational problems connected with spacecraft motion near the L2 Lagrangian equilibrium point are examined. A method is developed for the analysis and calculation of the single impulse transfer of a spacecraft from an intermediate Earth orbit to the conditionally periodic orbit that is most proximate to the L2 point. A numerical assessment is made of the characteristics of the single parameter correction of the transfer trajectory compensating for the orbit injection error. Author

N88-16101# Joint Publications Research Service, Arlington, Va.
STUDY OF DESCENT OF PROBES WITH HIGH LIFT-DRAG RATIO INTO THE ATMOSPHERE OF JUPITER Abstract Only **c91**
G. M. Lokhov and M. K. Rozhdestvenskiy *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 104

Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 193-203 Original language document was announced in IAA as A87-41735 (For primary document see N88-16063 08-42)
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Consideration is given to the descent of probes with low and high lift-drag ratios (LDRs) in the Jupiter atmosphere. The flight of a gliding probe with high LDR is considered in terms of the approximate selection of descent modes according to the minimum weight criterion of the thermal protection coating. An analysis is made of the feasibility of creating a program for the control of low LDRs by the removal of an additional film on the protective coating and for invariant turn angle control for assuring the maximum relative weight of segmented conical probe. Author

N88-16102# Joint Publications Research Service, Arlington, Va.
SELECTION OF EFFICIENT CORRECTING MOTOR FOR AN ARTIFICIAL EARTH SATELLITE Abstract Only **c18**
M. A. Kuzmin and Yu. N. Chilin *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 105 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 204-215 (For primary document see N88-16063 08-42)
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Mathematical modeling is used to study the influence of the functioning conditions of an Earth satallite and a number of parameters of its power system on the selection of an efficient type of correcting motor installation. The major quality characteristic of the operation of the power system, which is intended to provide electric power to spacecraft systems and achieve orbital correction, is the launch mass of the power system, determined by the total mass of solar batteries including solar panel opening and orienting systems, and the mass of the systems which stores the working fluid. A method is presented for determining areas of application of chemical and electrical reaction motors. Dimensionless parameters are presented to determine the expediency of using constant thrust electric reaction motors. Author

N88-16103# Joint Publications Research Service, Arlington, Va.
SATELLITE MONITORING OF EARTHQUAKE PRECURSOR EFFECTS IN MAGNETOSPHERE **c43**
Yu. I. Zaytsev *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 106-113 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow, USSR), no. 3, May - Jun. 1987 p 45-50 (For primary document see N88-16063 08-42)
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During satellite overflights of seismically active regions of the Earth, special equipment is recording bursts of electromagnetic radiation in the Earth's ionosphere and magnetosphere. These bursts frequently not only accompany a seismic shock, but also precede it. How these bursts can be used to predict earthquakes is addressed. Author

N88-16104# Joint Publications Research Service, Arlington, Va.
SPACE APPLICATIONS IN GEOGRAPHY **c43**
A. M. Grin *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 114-124 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 19-25 (For primary document see N88-16063 08-42)
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As the Earth's surface is being photographed from the Salyut-7 station, a survey of the Earth is being conducted by artificial Earth satellites, flying laboratories, and helicopters, and ground based observation points are helping out. These things help in the development of the science that studies the surface of the Earth, geography. Geographers have strived in recent years to replace graphic descriptions with quantitative values obtained by means and methods used by the precise sciences, primarily physics and chemistry. The addition of space based techniques to science's arsenal for studying the Earth's surface has made it possible for geographers to obtain an image of whatever natural or economic complex they are studying that is measured within an extremely wide range of electromagnetic waves, including not only the entire visible-optical range, but also those far beyond it, those encompassing thermal and radio emission. The effects of these techniques on the development of geography is examined. Author

N88-16105# Joint Publications Research Service, Arlington, Va.
METHOD FOR JOINT ADJUSTMENT OF SATELLITE AND SURFACE GEODETIC NETWORKS Abstract Only **c43**
B. M. Klenitskiy, K. K. Nasretdinov, and M. M. Khotin *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 125 Transl. into ENGLISH from Geodeziya i Kartografiya (Moscow, USSR), no. 5, May 1987 p 12-15 (For primary document see N88-16063 08-42)
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The purpose of joint adjustment of satellite and surface geodetic networks constructed in different coordinate systems is to obtain adjusted coordinates of stations in each network, taking into account the results of adjustments of other networks and tranformation elements in such a way that the adopted coordinate systems are not changed. An effort was made to develop an adjustment method which takes maximum advantage of newly available methods for processing measurements of extensive geodetic networks with minimum need for additional software. The proposed algorithm is readily integrated with traditional schemes for adjustment of such networks, such as the Pranis-Pranevich method, with solution of normal equations by the successive exclusions of unknowns. In comparison with the known method for integrating solutions, based on summing of the weighting matrices of individual networks, the new method does not require a procedure for obtaining a weighting matrix for the initial station of the surface geodetic network because it is based on the summing of correlation matrices. Author

N88-16106# Joint Publications Research Service, Arlington, Va.
METHOD OF DETERMINING ATMOSPHERIC MOISTURE CONTENT BY MEASUREMENT OF UPWARD RADIATION INTENSITY IN NEAR IR Abstract Only **c46**
Ye. V. Ovchinikova *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 126 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 44-50 Original language document was announced in IAA as A87-48182 (For primary document see N88-16063 08-42)
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A technique is proposed for determining the normalized water content of the atmosphere from upward radiation intensity measured in two spectral bands, 1.18 to 1.30 and 1.20 to 1.24 microns. It is shown that the ratio of the spatial variations of the upward radiation intensity in the two bands appears to be unambiguously related to the normalized water content. Using this approach, the contrast transfer function can be determined with sufficient accuracy if the atmospheric water content is known. Author

N88-16107# Joint Publications Research Service, Arlington, Va.
LIMITING ACCURACY OF SCATTEROMETER DETERMINATION OF WIND SPEED OVER OCEAN FROM SATELLITE Abstract Only **c47**
G. N. Khristoforov, A. S. Zapevalov, and V. Ye. Smolov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 127 Transl. into ENGLISH from Issledovaniye Zemli iz Kosma (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 57-65 Original language document was announced in IAA as A87-48184 (For primary document see N88-16063 08-42)
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Errors in determining wind velocities from scatterometer measurements are assessed, and it is shown that the highest accuracy of wind field determination is about + or - 1 m/s over the 4 to 17 m/s range. It is found that the velocity of weak winds cannot be accurately determined from remote measurements of sea ripple, while for velocities higher than 4 m/s the accuracy of scatterometer measurement is limited by a statistical spread of + or - 1 to 2 m/s. Author

N88-16108# Joint Publications Research Service, Arlington, Va.
SPACE PHOTOGRAPHS OF THE ONEGA-LADOGA ISTHMUS AND PREDICTION OF USEFUL MINERALS **c43**
Z. A. Bagrova and I. B. Antonova *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 128 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 66-72 Original language document was announced in IAA as A87-48185 (For primary document see N88-16063 08-42)
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The geological structural characteristics of the Onega-Ladoga isthmus as interpreted from space imagery is considered. Fault systems and ring structures were identified. This information along with available geological and geophysical data makes it possible to recognize signs of explosive magmatism and to predict the occurrence of bauxites and other minerals. Author

N88-16109# Joint Publications Research Service, Arlington, Va.
USE OF SPACE PHOTOGRAPHS FOR GEOMORPHOLOGICAL STUDIES IN SOUTHWESTERN TAJIKISTAN **c43**
V. P. Loziyev and M. S. Saidov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 129 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 73-80 Original language document was announced in IAA as A87-48186 (For primary document see N88-16063 08-42)
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Since 1977, complex studies of natural resources in Tajikistan have been performed based on space survey materials, space photographs of varying levels of generalization obtained onboard the Salyut manned spacecraft and the Cosmos automatic spacecraft. The results of these studies have shown that the materials of space photographic surveys can be successfully used for geomorphological mapping. The materials can be used in many cases to reproduce relief forms which have been destroyed by human economic activity and recognize buried elements which determine the lithologic and structural characteristics of sedimentary basins. The quality of transparency of the photographs allows determination of certain deep structural elements not observed by visual mapping. A table illustrates the relationship of recent tectonic movement and development of epiplatform relief in the area. Author

N88-16110# Joint Publications Research Service, Arlington, Va.
USE OF SPACE PHOTOGRAPHS FOR PALEOSEISMO-GEOLOGICAL STUDIES (ON THE EXAMPLE OF MONGOLIAN ALTAY) Abstract Only
A. L. Strom *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 130 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 81-84 Original language document was announced in IAA as A87-48187 (For primary document see N88-16063 08-42)
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It is demonstrated that, in Central Asia, young faults observed by space photographs can be reliably interpreted as paleoseismodislocations. Such faults are characterized by their manifestations as scarps and the presence of displacements of river beds or deluvial/proluvial cones. Author

N88-16111# Joint Publications Research Service, Arlington, Va.
STUDY OF RELIEF OF ORE REGIONS USING SPACE IMAGES (ON THE EXAMPLE OF EASTERN YAKUTIA) Abstract Only **c43**
V. A. Balandin *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 131 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 85-89 Original language document was announced in IAA as A87-48188 (For primary document see N88-16063 08-42)
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A study of many mining regions of Eastern Yakutia has shown that most of them coincide with areas of granitoids, associated with circular formations produced by endogenous structure forming factors. The method of locating these formations from space photographs is simple, involving a search for concentric sectors of divides and valleys, arch shaped image elements associated with changes in facies and intensity of jointing, isometric and arch shaped landscape zones and other similar characteristics. Ore zones are usually found around the outer contour of local circular formations or are associated with radially concentric cracks at their centers. The circular formations and lineaments of meridional, latitudinal and diagonal directions are found to be ore controlling characteristics. The space photographs agree with, but are more diagnostic than, structural geomorphological constructions in locating ore zones. Author

N88-16112# Joint Publications Research Service, Arlington, Va.
STATISTICAL MODEL OF INTERACTION OF ELECTROMAGNETIC WAVES WITH NATURAL OBJECTS BEING SENSED Abstract Only **c43**
V. V. Yegorov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 132 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 90-95 (For primary document see N88-16063 08-42)
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A study is made of a model of objects being sensed and the processes of interaction between the objects and the sensing electromagnetic field, utilizing models of tropospheric and ionospheric scatter communications channels. A statistical method of analysis is used, assuming scattering of the field to be Gaussian with zero mean and noncoherent summation of partial fields. The model includes the pulse response of the transmission path, which is demonstrated to be influenced by the spectral reflection properties of the object being sensed. Determination of the transfer functions of all elements involved in remote sensing makes possible a description of the entire monitoring loop and control of the status of natural and man made objects. Author

N88-16113# Joint Publications Research Service, Arlington, Va.
MONTE CARLO METHOD CALCULATION OF SPECTRAL BRIGHTNESS COEFFICIENT OF VEGETATION COVER AS FUNCTION OF ILLUMINATION CONDITIONS Abstract Only **c43**
Yu. K. Ross and A. L. Marshak *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 133 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 96-105 Original language document was announced in IAA as A87-48190 (For primary document see N88-16063 08-42)
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Results are presented from calculation of the variation of spectral brightness coefficient or index of reflection of a model of a vegetation cover as a function of the viewing direction. The influence of repetition of scattering and the fraction of scattered sky radiation in the total incident solar radiation is estimated. The variation of spectral brightness coefficient with zenith angle, azimuth of the Sun and brightness of the soil is analyzed. Calculations are performed for the area of photosynthetically active radiation at 380 to 710 nm. Vegetation is modeled by horizontal matte leaves and vertical nontransparent stems. It is found that the model can be limited to one time scattering, multiple scattering increasing the brightness by only 5 percent. The indices of reflection calculated for total and direct solar radiation differ little. Author

N88-16114# Joint Publications Research Service, Arlington, Va.
MODELING OF ARCHITECTURE OF A PROBLEM-ORIENTED ON-BOARD PROCESSOR Abstract Only **c35**
M. A. Aliyeva, V. N. Vintayev, and K. Kh. Ismailov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 134 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 112-117 (For primary document see N88-16063 08-42)
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A problem oriented conveyor processor with software modifiable configuration is suggested for onboard processing of multizonal images. The basic operational unit of the processor is a conveyor computing line. The basic module of the processor is a set of four such lines, switched arbitrarily to produce series or parallel circuits by means of a 4 channel switch. Each computing line includes RAM, an input functional converter, a service register set, a conveyor multiplier-adder, an adder-accumulator, and a normalizing register and output functional converter. High throughput and functional completeness are sought by designing for functional freedom with the minimum number of hardware modules utilizing MSI microcircuits. Author

N88-16115# Joint Publications Research Service, Arlington, Va.
MULTISTEP COMPONENT ANALYSIS OF CORRELATIONS Abstract Only **c43**
V. A. Kottsov and E. A. Gorbushina *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 135 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 118-122 Original language document was announced in IAA as A87-48193 (For primary document see N88-16063 08-42)
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The feasibility of using the principal component method to select optimal combinations of spectral channels in the multispectral remote sensing of the Earth is discussed. The optimization procedure employs differences in the indeterminacies of correlation matrix elements and eliminates them successively by comparison with a given accuracy threshold. The potential of the method is demonstrated by analysis of multispectral imagery obtained with the MKF-6 camera on Soyuz-22. Author

N88-16116# Joint Publications Research Service, Arlington, Va.
NEW POSSIBILITIES FOR USING GRAVITY DATA IN DEVELOPING GEODETIC COORDINATE SYSTEMS Abstract Only **c43**
L. P. Pellinen *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 136 Transl. into ENGLISH from Geodeziya i Kartografiya (Moscow, USSR), no. 3, Mar. 1987 p 10-13 Original language document was announced in IAA as A87-42939 (For primary document see N88-16063 08-42)
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Radio altimeter observations from GEOS-3 and Seasat as well as laser tracking observations of Lageos have opened new possibilities for the realization of geodetic coordinate system by the joint processing of ground measurements and satellite observations. A method is proposed for the processing of geodetic data which makes it possible to use height anomalies that are completely free of the indirect effect of geodetic coordinate errors. Author

N88-16117# Joint Publications Research Service, Arlington, Va.
PROCESSING OF RADAR IMAGES OF VENUS ON THE MAGISCAN-2 ANALYZER Abstract Only **c91**
A. Ya. Danilchenko, M. S. Markov, and M. V. Ostrovskiy *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 137 Transl. into ENGLISH from Geodeziya i Kartografiya (Moscow, USSR), no. 2, Feb. 1987 p 51-55 Original language document was announced in IAA as A87-44303 (For primary document see N88-16063 08-42)
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Relief features of the Venus surface were analyzed using the Venera program and the Magiscan-2 image analysis system. As an example, the program was used to identify lineaments on sheet B-4 of the radar map of the Venus surface with a scale of 1:5,000,000. Author

N88-16118# Joint Publications Research Service, Arlington, Va.
ADVANTAGES OF MANNED LUNAR BASE **c12**
V. V. Shevchenko *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 145-156 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 60-68 (For primary document see N88-16063 08-42)
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The Soviet Union has submitted to the member states of the UN a stage-by-stage program for joint operations in the peaceful development of space. The program goes up to the year 2000. It is suggested that conditions be created during that period of time that will enable the practical development and use of the Moon to begin as early as the first decades of the 21st century, with lunar settlements used as a base for flights to other planets. This would signify the creation of the actual prerequisites for Earth's civilization becoming, at the very beginning of the third millennium, an interplanetary civilization. The advantages of lunar bases for space exploration is examined. Author

N88-16119# Joint Publications Research Service, Arlington, Va.
USSR REPORT: EARTH SCIENCES
30 Mar. 1987 66 p Transl. into ENGLISH from various Russian articles
(JPRS-UES-87-003) Avail: NTIS HC A04/MF A01

Summaries from articles in the open literature are presented in the areas of meteorology, oceanography, terrestrial geophysics, physics of atmosphere, and arctic and antarctic research. For individual titles, see N88-16120 through N88-16140.

N88-16120# Joint Publications Research Service, Arlington, Va.
UPPER MANTLE HETEROGENEITY AND COMPOSITION OF PRIMARY OCEAN ISLAND MAGMAS Abstract Only **c48**
L. N. Kogarko *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 6 Transl. into ENGLISH from Geologiya i Geofizika (Novosibirsk, USSR), no. 7, Jul. 1986 p 74-80 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

Concepts concerning the heterogeneity of the earth's upper mantle with respect to rare and scattered elements have been developed in recent years. Heterogeneity of mantle sources has been most clearly established for ocean islands and the basalts of the mid-oceanic ridges and trenches. The question arises of the relationships between the composition of primary magmas of ocean islands and the distribution of rare and scattered elements in the mantle. Data from some 2,000 analyses of alkaline basalts on ocean islands reported in the literature plus rock materials collected in the South Atlantic during a research vessel cruise were used. A study of the analyses indicated that the mantle sources beneath these islands are rich in rare lithophilic and light rare earth elements. Isotope studies of alkaline-basalt series from the Grand Canary, Saint Helena and Tristan da Cunha areas indicate different mantle sources for the three areas. Manifestations of alkaline magmatism during geological time are intimately related to the heterogeneity of sub-crustal zones. The agreement of time of appearance of alkaline magmatism on the earth with the development of mantle substrate heterogeneity confirms the genetic relationship between these phenomena. Author

N88-16121# Joint Publications Research Service, Arlington, Va.
OCEAN FLOOR MAGMATISM AND PROBLEMS OF LITHOSPHERE FORMATION Abstract Only **c48**
L. V. Dmitriyev *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 7 Transl. into ENGLISH from Geologiya i Geofizika (Novosibirsk, USSR), no. 7, Jul. 1986 p 81-85 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

During the last five to ten years, petrology and geochemistry have developed rapidly, providing quantitative criteria for evaluation of geodynamic conditions of development of magmatism. This article discusses recent data on magmatism of the ocean floor. The following major geological structures are noted: (1) the ocean floor with its trenches and mid-ocean ridges; (2) volcanic islands and underwater volcanoes; (3) aseismic ridges; and (4) the active margins with troughs, island arcs and boundary seas. The data indicate that processes involving mixing and homogenization of mantle matter do not participate in the formation of mantle magma levels. This conclusion contradicts the common assumption of

convection in the mantle, which is thought to be the main motive force in lithospheric plate tectonics. Author

N88-16122# Joint Publications Research Service, Arlington, Va.
NATURE OF WESTERN PACIFIC TRANSITION ZONE Abstract Only **c48**
V. I. Ilichev and Yu. V. Shevaldin *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 8 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 290, no. 3, Sep. 1986 p 570-573 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

The inconsistency of the subduction model in the region of the Western Pacific transition zone requires formulation of a new, less contradictory model of deep processes and mechanisms of interaction between the continental and oceanic plates. Comparative data on the structure and spatial positioning of the Mid-Atlantic Ridge and Western Pacific transition zone were used to evolve alternative models of the zone. The authors postulate that the Mid-Atlantic Ridge and Western Pacific transition zone are elements on a single planetary structure of Late Meso-Cenozoic activation. The Meso-Cenozoic stage of activation of this structure apparently resulted from the latest impulse of expansion of the earth. The data presented on the similarity of elements in the structure of the Mid-Atlantic Ridge and Western Pacific transition zone provide a means for solution of another problem as well. The sequence of major events in the Phanerozoic, identical for the Atlantic and Pacific segments of the earth, indicates a single era of activation of belts of transform faults and active zones between faults for the entire earth and may be the mechanism which unites geological events in both hemispheres. Author

N88-16123# Joint Publications Research Service, Arlington, Va.
NEW DATA ON STRUCTURE OF EARTH'S CRUST AND SEISMICITY OF BASINS IN ATLANTIC AND INDIAN OCEANS Abstract Only **c48**
Yu. P. Neprochnov, V. V. Sedov, A. A. Pokryshkin, L. G. Akentyev, B. N. Grinko, A. A. Ostrovskiy, and B. V. Kholopov *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 10 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 290, no. 6, Oct. 1986 p 1448-1453 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

Geological and geophysical research in six test ranges was carried out in late 1983-early 1984. Deep seismic sounding was with self-contained bottom seismographs and powerful sound sources. Horizontal nonuniformity of the crust was studied in three of these ranges by running mutually perpendicular deep seismic sounding profiles. In general, the crust in each of these basins has structural features in common (three-layer structure, thickness of 5-8 km, nearly the same velocities of seismic waves in the layers), but there are distinctive features caused by the geological history of their formation and interplate tectonics. There is an anomalous crustal section in the Brazilian Basin. Author

N88-16124# Joint Publications Research Service, Arlington, Va.
EFFECTIVENESS OF OCEANOGRAPHIC METHOD IN EARTHQUAKE PREDICTION Abstract Only **c46**
G. G. Yakushko *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 11-12 Transl. into ENGLISH from Vulkanologiya i Seysmologiya (Moscow, USSR), no. 5, Sep. - Oct. 1985 p 101-104 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

Tide gauges can be used in registering vertical movements of the land and also afford possibilities for predicting earthquakes, although much additional work must be done to realize these possibilities. The oceanographic method already makes it possible to detect anomalies in vertical movements of the land of not less than 1-2 cm. An expression has been derived for computing the effective radius of the method. The method can be used in predicting relatively close earthquakes and could probably be effective in predicting earthquakes with M greater than or = 7.0 if the distance between level stations does not exceed 80 km. It is highly important that the observation points be situated as close as possible to the epicentral zone of an anticipated earthquake. Bottom pressure sensors are now available which can measure ocean level distant from its shores with a high degree of accuracy, thereby making it possible to study vertical movements of both the land and ocean floor, in the latter case inaccessible for other observation methods. It is probably possible to detect earthquake precursors in this way. In the Far Eastern region especially, the use of bottom pressure detectors may become an effective method for predicting earthquakes. Author

N88-16125# Joint Publications Research Service, Arlington, Va.
NEOGENE PALEOCLIMATE IN PACIFIC OCEAN SUBARCTIC REGION DETERMINED FROM STUDY OF DIATOMS Abstract Only **c48**
T. V. Oreshkina *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 15-16 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Seriya Geologicheskaya (Moscow, USSR), no. 11, Nov. 1986 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

The paleoclimate of the northwestern part of the Pacific Ocean was reconstructed on the basis of diatom analysis almost 25 years ago. The stages in climatic changes and changes in sea level in the Pleistocene were determined by the actualism method. This was followed by similar work for a number of other areas by the same method. However, retrieval of climatic trends for the Neogene or Paleogene must be based on detailed stratigraphic research. The great amount of data on the stratigraphic distribution of diatoms accumulated in the DSDP can be used as a basis for the retrieval of temperature fluctuations from the quantitative ratio of warm- and cold-water species. Diatoms can be used in interpreting climatic changes and paleoocenaography of the Late Cenozoic. Neogene diatoms have been used in a paleoclimate reconstruction. It is demonstrated that during the Neogene in the North Pacific there was a repeated change in different ecological associations in time and space. The climate in that region changed from the first half of the Middle Miocene to the end of the Pliocene from subtropical to subpolar. These and other findings indicate that changes in the ecological structure of diatom complexes are a reliable indicator of environmental changes. Author

N88-16126# Joint Publications Research Service, Arlington, Va.
SEA RESONANCE VIBRATIONAL SOURCE OF SEISMIC WAVES Abstract Only **c48**
G. V. Yegorov and A. A. Zuyev *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 16-17 Transl. into ENGLISH from Geologiya i Geofizika (Novosibirsk, USSR), no. 9, Sep. 1986 p 111-115 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

When using the vibrational method for deep seismic sounding on the shelf and in the continent-ocean transition zones it is feasible to use sea vibrational sources of seismic waves; they are more transportable than land sources of the same power. The requirement is for the generation of waves in the frequency range from 4 to 12 Hz with a total radiated power up to 100 kWh or more. The optimal depth of submergence of such a source is 1/4 the wavelength. A fixed depth of source submergence can be optimal only for one radiation frequency. The strength of the signal radiated from the source must be such that the signal-to-noise ratio at reception points is satisfactory when the duration of source transmission is 1-2 hours. A possible simple variant of such a source is described. A cylindrical dome is lowered over the ship's side. The initial air volume in this dome ensures resonance at the maximum frequency in the used frequency range. The dome is open at the bottom and the air which serves as the pneumatic spring is bounded by the upper base of the dome and the water surface beneath it. There are inlet and outlet valves whose operation is automatically synchronized with air variations under the dome. The operating principle is described; the principal characteristics of the proposed vibrator are defined, including their dependence on frequency and the law of change of vibrator resonance frequency with time. Author

N88-16127# Joint Publications Research Service, Arlington, Va.
ELECTROMAGNETIC INDUCTION IN SPHERICAL EARTH CONTAINING OCEANS AND CONTINENTS IN ELECTRICAL CONTACT WITH UNDERLYING SECTION: THEORY, METHOD, EXAMPLE **c46**
B. Sh. Zinger, A. V. Kuvshinov, and E. B. Faynberg *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 19 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Zemli (Moscow, USSR), no. 10, Oct. 1986 p 51-65 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

The problem of allowance for the influence of surface inhomogeneities on the results of deep electromagnetic sounding is one of the most important in geoelectrics. In an effort to solve this problem, the character of electromagnetic induction in a spherical earth containing oceans and continents, theoretical principles are set forth of the so-called iterative-dissipative method as applicable to the problem and the basic thin inhomogeneous surface layer in galvanic contact with the underlying stratified section. The current system induced by a uniform magnetic field in a model with a real distribution of surface conductivity was computed. A section with a power law conductivity change was used as the underlying surface. The employed model reveals that there are considerable leakage currents from the inhomogeneous surface layer despite high transverse resistance of the crust and upper mantle. A specific example of the numerical modeling is given. The example confirms the important role of leakage currents in the formation of electromagnetic fields induced in the earth and the need for taking these currents into account in deep electromagnetic soundings. Author

N88-16128# Joint Publications Research Service, Arlington, Va.
GEOMECHANICAL MODEL OF SEISMOFOCAL ZONE OF ACTIVE CONTINENTAL MARGIN Abstract Only **c46**
S. S. Demin and S. Ye. Zharinov *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 28 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 290, no. 6, Oct. 1986 p 1339-1342 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

A new approach to the modeling of the geomechanics of the active continental margin is proposed in which upthrust movements along a fault seismofocal zone are assumed to be the structure-forming mechanisms. The model can be used in describing the mechanism of formation of the active margin in the process of slow tectonic movement of continental and oceanic blocks along a fault seismofocal zone and the individual seismic movements accompanying this process. The model can be used in estimating tectonic compression and effective parameters of the medium. Usefulness of the model is illustrated in a specific case in which the nature of free surface displacements corresponds to the principal relief forms of the continental margin (island arc uplift, depression, abyssal trench and marginal sea), with the amplitude and scale of the displacements being consistent with the characteristic dimensions of the morphostructures. The proposed tectonic mechanism, different from the subduction mechanism, is effective in explaining a number of features which would remain unexplained if the subduction model was applied.
Author

N88-16129# Joint Publications Research Service, Arlington, Va.
COMPREHENSIVE METHOD FOR DEFINING SEISMOGENIC ZONES Abstract Only **c46**
T. O. Babayan *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 29-30 Transl. into ENGLISH from Izvestiya Akademii Nauk Armyanskoy SSR: Nauki o Zemle (Yerevan, USSR), no. 3, May - Jun. 1986 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

Since study of seismogenic zones makes it possible to predict the place and intensity of earthquakes it is important to clarify the seismogenic nature of tectonic dislocations, making use of their seismological and geological-tectonic criteria. This problem is clarified in the examples of a region in Armenia. Criteria of seismicity are considered in the areas of seismology, geology, geophysics, and hydrogeology. By a generalization of these criteria it is possible to conclude whether particular tectonic dislocations are seismogenic (capable of generating earthquakes). Author

N88-16130# Joint Publications Research Service, Arlington, Va.
DETERMINING DEEP HEAT FLOW UNDER COMPLEX GEOTHERMAL CONDITIONS Abstract Only **c46**
A. R. Kurchikov and B. P. Stavitskiy *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 33 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Seriya Geologicheskaya (Moscow, USSR), no. 11, Nov. 1986 p 121-127 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

It was found that there are many reasons why it was essential to develop a new approach to determining deep heat flow in regions where complex conditions prevail. An approach is proposed which makes it possible to calculate q (heat flow density) in virtually all cases. The basis of the mathematical model for determining heat flow is the difference between the concepts of normal and natural geotemperature fields. Formulas are derived which give highly accurate results even in regions with a very complex paleoclimatic history, such as Western Siberia. On the other hand, the method has its limitations. For example, it is necessary to have a definite number of experimentally determined values of the thermal conductivity coefficient for the main types of rocks making up the section in order to clarify the nature of the change in thermal conductivity with depth. This and other difficulties are readily overcome and the quite simple method proposed can be used effectively in determining the distribution of deep heat flows.
Author

N88-16131# Joint Publications Research Service, Arlington, Va.
CORRELATION BETWEEN SEISMIC ACTIVITY AND VARIATIONS OF MICROSEISMIC OSCILLATIONS Abstract Only **c46**
Ya. S. Sharipov *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 39-40 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Zemli (Moscow, USSR), no. 10, Oct. 1986 p 99-106 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

There is a definite correlation between the level of short-period microseisms and seismic activity. A negative correlation exists between the diurnal changes in the level of microseisms and the number of regional earthquakes. The mean daily fluctuations of levels of microseisms exhibit a positive correlation. The mean daily level exhibits no significant correlation with seismic activity, which may be a result of predominance of industrial noise in the course of a large part of the day. The mean daily variations in the nighttime level of microseisms (measured with a 1-hour interval) are correlated with the mean variations of seismic activity over the course of 24 hours. The correlation level drops to -0.25. These results in general are consistent with research data indicating a correlation between seismic activity and the level of high-frequency noise and storm-generated microseisms, as well as with the increase in the level of high-frequency microseisms several hours prior to strong earthquakes. Author

N88-16132# Joint Publications Research Service, Arlington, Va.
DETERMINING TRAJECTORY OF GROUND MOVEMENT ACCOMPANYING SEISMIC PHENOMENA Abstract Only **c46**
V. M. Grayzer *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 40 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Zemli (Moscow, USSR), no. 10, Oct. 1986 p 14-19 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

Two schemes are proposed for constructing trajectory measurement systems on the basis of six-pendulum accelerographs which make possible separate determination of translational and rotational movement of the soil, excluding the influence of the transverse component of oscillations. These methods are similar to those developed for inertial navigation. It would be possible to employ three accelerometers oriented in three mutually

perpendicular directions, mounted on a platform and spatially stabilized using gyroscopic instruments. Without changing its orientation at the earth's surface, the platform precludes the influence of rotations of the instrument base and makes it possible to register purely translational accelerations. Integration of accelerometer readings, assuming a high resolution, makes it possible to determine the rate and displacement of the instrument base. Another possible variant provides for use of three accelerometers and three gyrotachometers for measuring angular accelerations, with accelerations and rotations being registered independently. The latter variant is preferable since it is easier to construct. Author

N88-16133# Joint Publications Research Service, Arlington, Va.
ACADEMIC COURSE SPACE METHODS FOR STUDYING MODERN LANDSCAPES OF CONTINENTS c43
Ye. V. Glushko *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 41 Transl. into ENGLISH from Vestnik Moskovskogo Universiteta: Seriya 5, Geografiya (Moscow, USSR), no. 6, Nov. - Dec. 1986 p 78-82 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

In this course the emphasis is on the study via space photographs of present-day landscapes incorporating both natural and anthropogenic components. The following topics are included: (1) theoretical principles of space methods for landscape research, including optical properties of landscapes, and the system for the classification of modern landscapes; (2) study of the structure of modern landscapes by means of interpretations of space photographs and subsequent mapping; (3) natural and anthropogenic landscape components and principal types of environmental pollution identifiable on space photographs; (4) study of present-day analogue landscapes; and (5) study of natural and anthropogenic processes, as well as rhythmic, dynamic and evolutionary changes of landscapes from space photographs. In their practical work, students use space photographs in the interpretation of Quaternary deposits, relief, hydrographic network, soils, vegetation and land use. Author

N88-16134# Joint Publications Research Service, Arlington, Va.
GREATEST VOLCANIC ERUPTIONS IN WORLD DURING 17TH-18TH CENTURIES AND WEATHER ANOMALIES IN EURASIAN MIDDLE LATITUDES Abstract Only c46
S. I. Varushchenko *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 41-42 Transl. into ENGLISH from Vestnik Moskovskogo Universiteta: Seriya 5, Geografiya (Moscow, USSR), no. 6, Nov. - Dec. 1986 p 64-71 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

In order to broaden the base for a model of climatic effects of volcanic activity, materials from the 17th and 18th centuries based on paleogeographic, geological and historical sources were used. A grouping by five-year periods made it possible to assess how weather conditions in a number of regions in Eurasia reacted to different atmospheric contents of volcanic aerosols. The effects were analyzed for Switzerland, Russian plain, and Japan. In general, a demonstrable correlation exists between volcanic eruptions and subsequent weather conditions. Particularly prominent among such weather phenomena were very cold and very moist seasons. The anomalies in most cases were expressed about 1.5 years following the eruptions. The exclusive role of volcanic events in subsequent weather is not claimed, but this is a factor which must be taken into account in forecasts in the one to three years which follow. Author

N88-16135# Joint Publications Research Service, Arlington, Va.
PHOTOGRAMMETRIC PRINCIPLES FOR COMBINING REMOTE SOUNDING AND THREE-DIMENSIONAL MAPPING Abstract Only c43
O. R. Musin, B. A. Novakovskiy, and S. N. Serbenyuk *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 42-43 Transl. into ENGLISH from Vestnik Moskovskogo Universiteta: Seriya 5, Geografiya (Moscow, USSR), no. 6, Nov. - Dec. 1986 p 56-64 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

Some aspects of automated three-dimensional mapping of the relief image of the earth's surface on the basis of photogrammetric digital terrain models are described. Attention is given to the role of photogrammetry in the further introduction of remote sounding in cartographic work and geographical research. The possibilities afforded by combining remote sounding and three-dimensional mapping are illustrated in the example of cartometric interpretation of a fragment of a digital terrain model using the AKS-MGU automated cartographic system. The user is supplied with a definite set of mutually supplementing metric and nonmetric components of three-dimensional mapping which may or may not be matched with the initial photographic image. The photogrammetric methods make it possible to introduce remote sounding into geographical research by a quantitative interpretation of aerial and space photographs. This is an effective means for forming a digital data base which can be used in obtaining a wide range of cartometric and morphometric indices, which are key elements of three-dimensional mapping. Author

N88-16136# Joint Publications Research Service, Arlington, Va.
LASER SYSTEM FOR AUTOMATING TOPOGRAPHIC TERRAIN SURVEY Abstract Only c43
V. S. Golov, Yu. M. Desyatykh, A. S. Fedorov, and A. G. Paramonov *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 47 Transl. into ENGLISH from Geodeziya i Kartografiya (Moscow, USSR), no. 10, Oct. 1986 p 38-41 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

An experimental model of a system based on a helium-neon laser was developed for the purpose of finding ways to automate a topographic survey. The system consists of a transmitter mounted over a point with known coordinates (theodolite traverse station) and a receiver which during the course of the survey is moved along the line. The transmitter includes a laser transmitter with a rotating head and a radio transmitter. The laser transmitter shapes two beams, one of which is horizontal, whereas the other slants at the angle beta to the horizon. The lower beam during rotation of the head creates a horizontal plane, whereas the upper beam creates a conical surface. In the form of pulses the radio transmitter transmits information on the angle of rotation of the rotating head relative to the initial direction. The initial direction is the direction to the second theodolite station, at which the receiver is placed prior to onset of the survey. The receiver consists of a photodetector with a circular-scan objective which is attached on a telescopic rod which is used for moving it vertically. It has a movement-code converter and a computer with a digital display for indicating the three determined coordinates. In the base there is an electromechanical drive for raising and lowering the photodetector. The working principles and procedures are described. Author

N88-16137# Joint Publications Research Service, Arlington, Va.
ALLOWANCE FOR INFLUENCE OF GRAVITY FIELD NONUNIFORMITY Abstract Only c46
A. P. Tsysar *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 48 Transl. into ENGLISH from Geodeziya i Kartografiya (Moscow, USSR), no. 10, Oct. 1986 p 5-8 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

The constants of a quartz-metal pendulum used in higher-order gravimetric networks have been determined and a formula has been derived for the total correction for gravity field nonuniformity measurements made with the pendulum. Nomograms were constructed on the basis of these formulas and are used in introducing corrections into pendulum measurements. A table was prepared giving the components of the correction for some values of the derivatives of gravity potential from surrounding masses. Errors can be caused by building walls, the pedestal on which the instrument sits and other factors, and these must be taken into account since they increase the normal gravity gradient. After introducing these correction components for the nonuniform gravity

field, the gravity field at the measurement point is related to the instrument point coinciding with the middle of the pendulum knife blade. Author

N88-16138# Joint Publications Research Service, Arlington, Va.
STUDY OF ASTHENOSPHERE: PROJECT ELAS Abstract Only c46

L. L. Vanyan *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 49 Transl. into ENGLISH from Vestnik Akademii Nauk SSSR (Moscow, USSR), no. 9, Sep. 1986 p 54-61 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

The scientific basis of Project ELAS (electroconductivity of the asthenosphere) is discussed. The joint use of electromagnetic and geothermal data can be productive in the study of partial melting in the asthenosphere. The top of the zone of partial melting is observed in geothermal studies as the depth of the solidus. The conductivity of this zone is most reliably determined by electromagnetic methods. It reflects the full content of the basalt melt in the asthenosphere. Partial melting is observed beneath the Pacific Ocean and the Far Eastern transition zone, but not beneath the Precambrian plates of the continents. In the first stage of Project ELAS, 1978-1985, primary attention has been given to deep electroconductivity. Significant lateral heterogeneity in the asthenosphere has been found: partial melting developed beneath the oceans (except for the most ancient regions), but not beneath the Precambrian plates. The second stage in the project will involve joint study of the asthenosphere by various geophysical methods. Author

N88-16139# Joint Publications Research Service, Arlington, Va.
METHOD FOR DETERMINING ATMOSPHERIC TEMPERATURE PROFILES FROM OBSERVATIONS OF ASTRONOMICAL REFRACTION OF STARS Abstract Only c89

N. A. Vasilenko, K. P. Gaykovich, and M. I. Sumin *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 50-51 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 290, no. 6, Oct. 1986 p 1332-1335 Original language document was announced in IAA as A87-25146 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

Theoretical and experimental work was done to determine the possibilities of retrieving vertical temperature profiles from refraction measurements when observing celestial bodies from the surface at positive angles of elevation. This required derivation of a fundamental equation which relates refraction epsilon and the atmospheric refractive index n, which is reduced to a Fredholm equation of the first kind by integration by parts. Two algorithms were written for solving the new equation involving use of the statistical regularization method or a compact class of monotonic functions. Suggestions are made on overcoming a number of inherent difficulties in the problem. Effectiveness was checked by comparing retrieved profiles and aerological sounding data (in the example of combined astronomical and aerological observations in a semidesert region). Specific data from practical application of the method are cited. These examples indicate that the accuracy of measurements of refraction, the accuracy in computing the kernel of the pertinent integral equation and the degree of correspondence of the spherically symmetric approximation to the real atmosphere meet all requirements. Retrieval accuracy is equal to that obtained by surface microwave radiometry methods. Author

N88-16140# Joint Publications Research Service, Arlington, Va.
MESOSCALE AEROSOL CLOUDS Abstract Only c46

B. D. Belan and G. O. Zadde *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 51 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 290, no. 6, Oct. 1986 p 1328-1331 Previously announced as X87-73576 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

An atmospheric phenomenon detected during aircraft sounding of the atmosphere in 1981 and 1983-1985 is described. Regions with an increased aerosol concentraion with a horizontal scale 10-20 km were detected in the clear dry atmosphere at altitudes exceeding 1000 m. Air temperature and humidity remain almost constant during these events and local aerosol sources are absent both in the atmosphere and at the earth's surface. Such regions were observed over Kazakhstan and Western and Eastern Siberia. The distinguishing characteristic of the appearance is a very low relative humidity of less than 40 percent regardless of air temperature. The altitude of formation varies from 1200 to 4530 m. The aerosol concentration in the clouds is usually much greater than in the surrounding medium. They are usually observed after 1400 hours. Such phenomena are observed in regions under the influence of an anticyclone or at the rear of a cold front where there are Cu hum clouds. The possibility of an anthropogenic origin of these clouds is precluded. The greatest number of clouds observed in the aerosol field is 11. Such an aerosol cloud has a vertical extent of 300-600 m with a horizontal extent of 12 km. The clouds may be the dry remnant of a water cloud which evaporates after lessening of the convection feeding the cloud or may be an independent atmospheric formation arising for unknown reasons; alternatively, there is a convective mechanism of formation of aerosol clouds. Author

N88-16141# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
RESEARCH WORK AT THE METEOROLOGICAL INSTITUTE OF THE UNIVERSITY OF MUNICH (FEDERAL REPUBLIC OF GERMANY) [ARBEITEN AUS DEN ABTEILUNGEN DES METEOROLOGISCHEN INSTITUTS DER UNIVERSITAET MUENCHEN]

Norbert Beier, ed. Mar. 1987 231 p In GERMAN
(Mitt-56; ETN-88-90792) Avail: NTIS HC A11/MF A01

Micrometeorology, theoretical meteorology, and radiation and satellite meteorology are treated. For individual titles, see N88-16142 through N88-16178.

N88-16142# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
CROSS FLOW IN THE ALPS AND FLAT FOEHN DURING THE EXPERIMENT MERKUR [UEBERSTROEMUNG DER ALPEN UND FLACHER FOEHN WAEHREND MERKUR] c47

Michael Ahr *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic oof Germany) Mar. 1987 p 3-9 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

The spatial distribution of the time evolution of the dynamic effects of cross winds, as well as thermal effects during the formation of circulation systems were investigated during a mesoscale experiment in the Alps. The interaction between mountains and foreland during cross flow (e.g., during foehn) is explained. The effect of valleys during the cross flow, and the influence of foehn in mountain valleys and in the foreland, were determined. The diurnal wind systems and the dispersion of pollutants were elucidated. ESA

N88-16143# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
USE OF THE THERMODYNAMIC EVAPORATION FORMULA OF HOFFMANN IN ENERGY BALANCE MODELS FOR FLOWING WATER [DIE ANWENDUNG DER THERMODYNAMISCHEN VERDUNSTUNGSFORMEL NACH HOFMANN IN ENERGIE-BILANZMODELLEN VON FLIESSGEWAESSERN] c43

Norbert Beier *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 10-17 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

A linearized model equation of the first order nonlinear differential equation for the calculation of flowing water temperature was deduced. The assumptions leading to the linearized model equation are discussed. The introduction of the thermodynamic

evaporation formula of Hoffmann leads to a piecewise analytically model equation, suitable for operational use. The resulting approximation is only sufficiently accurate if air and water temperature differ only slightly. Otherwise, the model equation has to be expanded around the residual term of the Taylor expansion. However, the obtained accuracy is generally sufficient for the applications, given the limited accuracy of the meteorological and hydrological input quantities of the energy balance models. ESA

N88-16144# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
THE ROLE OF ANABATIC WINDS IN THE HEATING OF VALLEYS [DIE ROLLE DER HANGWINDE BEI DER ERWAERMUNG VON TAELERN] c47
Matthias Brehm *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 18-23 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

The heating of mountain valleys at sunrise was investigated. The characteristic temperature structures in mountain valleys after sunrise were measured. Glider flights show that in a valley cross section outside the anabatic wind layer, the isotherms are largely horizontal, and that the thermal effect of the anabatic wind layer is limited to 100 m. A conceptual model for the valley heating, which elucidates the role of the anabatic wind, is presented. A simple box model for the energy transfer phenomena in the anabatic wind layer and in the valley atmosphere is presented; the results of the simulation are in good agreement with the measurements. ESA

N88-16145# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
ENERGY BALANCE AND DISCHARGE OF AN ALPINE GLACIER, ILLUSTRATED BY MOUNT VERNAGTFERNER IN THE OETZAL ALPS, TYROL [ENERGIEBILANZ UND ABFLUSS EINES ALPENGLETSCHERS DARGESTELLT AM BEISPIEL DES VERNAGTFERNERS IN DEN OETZTALER ALPEN/TIROL] c43
Heidi Escher-Vetter *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 24-29 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

A meteolorogical-hydrological glacier discharge model was developed. The model approximation for the energy balance from which the available melted snow and ice are deduced is presented. The simulation of the discharge at a weather station using a mathematical model is explained. The results show that a simple energy balance model allows the calculation of the melted snow and ice production in a limited area, with a time and superficial resolution sufficient to use the data as input for a discharge model. Although not all phenomena were modeled in detail, there is good agreement between the modelled and the measured discharge. ESA

N88-16146# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
RESULTS OF THE EXPERIMENT MERKUR: STRUCTURAL CHANGE OF A WEAK COLD FRONT IN THE SPHERE OF INFLUENCE OF THE ALPS [ERGEBNISSE DES EXPERIMENTS MERKUR: STRUKTURAENDERUNG EINER SCHWACHEN KALTFRONT IM EINFLUSSBEREICH DER ALPEN] c47
Carl Freytag *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 30-36 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

The structure of a weak cold front was investigated in the mountains and at the frontier region between mountains and foreland in the framework of the international Alpine Experiment (ALPEX). The general weather development in the period of the MERKUR measurements is depicted. The characteristics of the cold front (temperature changes and front heights) are described. The development of the cold front in the Alpine foreland and its effects (pressure, precipitation, temperature, wind field) are explained. The penetration of the front into the mountains is described. ESA

N88-16147# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
THE UNSTEADY GROUND HEAT FLOW AT THE CONTACT SURFACE BETWEEN A GLACIER RUN AND THE SUBSOIL [DER INSTATIONAERE BODENWAERMESTROM AN DER KONTAKFLAECHE EINES GLETSCHERBACHES ZUM UNTERGRUND] c43
Waldemar Gereke *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 37-42 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

A method for the estimation of the heat conducted from the glacier subsoil into the glacier run water was developed. The bed profile of the glacier run was modeled using a Schwarz-Christoffel conformal mapping. The proposed method calculates the heat flow in the case of a semi-infinite flat surface, and hence the increase of the water temperature of the glacier run. The comparison between calculated and measured data shows good agreement. ESA

N88-16148# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
A SEMIANALYTICAL SOLUTION OF THE HEAT CONDUCTION EQUATION FOR SEVERAL BOUNDARY CONDITIONS [EINE HALBANALYTISCHE LOESUNG DER WAERMELEITUNGSGLEICHUNG BEI VERSCHIEDENEN RANDVORGABEN] c34
Barbara Hennemuth and Hans Joachim Oberle *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 43-49 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

A semianalytical method to solve boundary-initial-value tasks for the heat conduction equation is described. The method is based on the explicit calculation of the Fourier series for the solution of the heat conduction equation with homogeneous boundary conditions. Two examples are treated to demonstrate the method: the temperature distribution in the atmospheric boundary layer over sea in the case of land wind; and the temperature distribution in the soil to a depth of 1 m for a given variable heat flow throuh the surface. The results of the first example are in satisfactory agreement with measurements; the temperature distribution in the second example agrees well with previous results. ESA

N88-16149# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie
TURBULENCE STRUCTURE DURING HIGH WIND [TURBULENZSTRUKTUR BEI STARKWIND] c47
Heinz Loesslein *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 50-54 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

The vortices during high winds and storms were investigated to develop a wind load concept. The wind velocity during storms was measured with cup anemometers. The autocorrelation was calculated on the basis of 10 min time series with an average wind velocity greater than 10 m/sec. The determination of the gust front inclination from the vertical cross correlation of two wind velocity time series is discussed. The calculation of the horizontal cross correlation of two time series measured at different towers at the same height, and the determination of the coherence spectrum from two time series measured at different heights at the same location, are discussed. ESA

N88-16150# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
EXTRAPOLATION OF EXTREMUM VALUES OF THE WIND VELOCITY [EXTRAPOLATION VON EXTREMWERTEN DER WINDGESCHWINDIGKEIT] **c47**
Hans Schroers *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 55-61 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

Three methods for extremum value extrapolation, based on long wind velocity measuring series, are presented, for the forecasting of extreme wind loads on buildings and structures. The exceeding probability of a wind velocity using Gaussian probability paper is the simplest method, but has the disadvantage that a large number of data has to be measured and processed. The extrapolation via a two-dimensional logistic wind velocity distribution has the same disadvantage, and has a comparable statistical safety margin as the first method. Extrapolation via the Fischer-Tippet type 1 extremum distribution has the advantage that only the highest measured velocities have to be known; it delivers false results for short measuring series. The effect of the duration of the measuring period on the extrapolation is discussed. ESA

N88-16151# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
DETERMINATION OF THE HEAT CONDUCTION COEFFICIENT OF THE SOIL FROM THE ADVANCE OF THE DIURNAL TEMPERATURE WAVE [BESTIMMUNG DES WAERMELEIT-KOEFFIZIENTEN DES BODENS AUS DEM VORDRINGEN DER TAEGLICHEN TEMPERATURWELLE] **c34**
Stephan Traup *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 62-67 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

Diurnal averages of the soil's heat conduction coefficient, lambda, were determined as a function of weather conditions, using soil temperature measurements. Three methods for the calculation of lambda are presented. The determination of lambda from the diurnal amplitude ratios of the soil temperatures at two depths requires a large number of measuring points and not too small amplitudes of the diurnal soil temperature waves. The second method calculates lambda from the harmonic analysis of the diurnal temperature variations of the partial waves at two depths; the errors increase for higher harmonic numbers. The third method calculates lambda from the phase shift between the partial waves at two depths. The first method provides generally satisfactory results in summer time. An extrapolation of the curves for lambda in a dry period after heavy precipitation determines lambda of the dry soil. ESA

N88-16152# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
VERTICAL SOUNDING OF TH AIR LAYER CLOSE TO A GLACIER ON MOUNT VERNAGFERNER IN THE OETZAL ALPS, TYROL (EXPERIMENT LUZIVER 1983) [VERTIKALSONDIER-UNGEN DER EISNAHEN LUFTSCHICHT AM VERNAGTFER-NER (LUZIVER 1983)] **c47**
Markus Weber *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 68-72 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

The vertical profiles of wind, temperature, and moisture close to a glacier were measured between 300 and 2979 m using captive probes, pilot balloon ascensions, and mast measurements. Time-height wind velocity plots are explained. A distinct separation between glacier wind layer and cross wind is difficult using only the wind velocity profiles. Therefore, the equivalent-potential temperature isoline, obtained from mast measurements, are needed. The correlation between temperature gradients and glacier wind is explained. The range of the glacier wind in the foreland is discussed. The results show that the development of the glacier wind regime in the last decameter above the glacier is determined by the synoptic situation and the orography. ESA

N88-16153# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
THE ENTROPY OF THE LORENTZ MODEL [ZUR ENTROPIE DES LORENZMODELLS] **c65**
J. Egger *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 74-76 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

The entropy concept for a dynamic system is discussed via the Lorentz model which describes convection rolls in the Rayleigh-Benard problem by only three variables. The equations of the Lorentz model, that has a tendency towards chaotic solutions, are presented. The entropy consideration of the Lorentz model is presented, based on the assumption that the microstate, i.e., the precise distribution of the solutions in phase space, is unknown. The time evolution of the entropy is determined for typical cases. ESA

N88-16154# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
SIMULATION OF A TYPICAL FLOW IN A BROAD VALLEY [SIMULATION EINER TYPISCHEN STROEMUNG IN EINEM BREITEN TAL] **c47**
Jutta Graf *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 77-79 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

The atmospheric circulation in a broad valley was simulated using numerical models, to study pollution transport. The simulation was performed for a valley which is 80 km long and 10 to 25 km broad. A mesoscale model, taking into account topographic effects, was used, together with a measured temperature profile. Under the given synoptic conditions, the model provides the typical east ground wind; higher up the wind turns into the direction of the geostrophic wind. Comparison with measured wind profiles shows satisfactory agreement. ESA

N88-16155# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
MODEL CALCULATIONS OF THE BEHAVIOR OF OROGRAPHICALLY INFLUENCED COLD FRONTS [MODELLRECHNUNGEN ZUM VERHALTEN OROGRAPHISCH BEEINFLUSSTER KALTFRONTEN] **c47**
Klaus Haderlein *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 80-83 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

The shift behavior of orographically modified cold fronts was investigated using a simple numerical layer model, in order to clarify the effect of mountains on front-like situations. The model forecasts the behavior of a single barotropic layer (cold air layer) using the physics of the flat-water equations in the f-phase, and one- and two-dimensional mountain profiles. The numerical errors are negligible for one-dimensional mountain profiles, but significant close to the soil for two-dimensional profiles, although the numerical calculations are also in that case qualitatively reliable. This simple model cannot take into account modifications of the vertical wind field. The results show that the motion of the front in the neighborhood of the mountains is not symmetrical with the mountain profiles, in agreement with theoretical and experimental investigations. ESA

N88-16156# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
DENSITY FLOWS AT THE MOUNTAIN EDGE [DICHTESTROEMUNGEN AM GEBIRGSRAND] **c47**
G. Hartjenstein *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 84-88 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

A simple model concept was used to investigate the behavior of cold fronts in the neighborhood of mountains, and especially the phenomenon of the southerly buster, a very fast moving squall line that often leads the cold front and causes a strong pressure increase. The two-layer model (flat-water equations, f-plane) shows the propagation velocity of the orographic jet. The extension of the model concept to multiple layers shows that a more or less diffuse frontal zone develops to a front that is especially pronounced close to the soil. The model provides a qualitative explanation for the observed enhancement of the temperature gradients on the Australian south-east coast. ESA

N88-16157# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
PROGNOSIS USING SPECTRAL EMBEDDING [PROGNOSE MITTELS SPEKTRALER EINBETTUNG] **c47**
F. Schmidt and A. Klos *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 89-93 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

The spectral embedding method was used to solve prognosis problems. The method is based on Fourier functions with small periods, and is characterized by distortion freedom. Boundary problems are reduced to coupling and continuation problems. The method was tested on the linearized, spatially one-dimensional, potential vorticity equation. The usefulness in principle of the spectral embedding is demonstrated. Refinements are needed for an operational use in weather forecasting. ESA

N88-16158# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
SYNOPTIC PERTURBATIONS AND CLIMATE [SYNOPTISCHE STOERUNGEN UND KLIMA] **c47**
Werner Metz *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 94-97 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

A modified stochastic model of the synoptic excitation mechanism responsible for blocking anticyclones was developed. The synoptic-scale excitation functions were developed in a series of orthogonal functions the amplitudes of which were modeled as a first order Markov process. The reaction of a simple barotropic model on these synthetic excitation mechanism leads to a geographic distribution of the variance of the planetary modes, in close agreement with other models and with observations. The results are a first step toward a parameterization of the influence of synoptic perturbations on the low frequency variability of the planetary flow. ESA

N88-16159# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
THE BIMODALITY OF LARGE SCALE AVERAGED FLOW PARAMETERS [ZUR BIMODALITAET GROSSRAEUMIG GEMITTELTER STROEMUNGSPARAMETER] **c47**
Heinz-Dieter Schilling *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 98-102 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

The existence of two modes, i.e., two states with maximum probability, in histograms of large scale averaged atmospheric circulation parameters was investigated. The existence of the bimodality for a parameter, known from the energetics of the underlying equations, and playing a role in the large scale dynamics, is demonstrated. A condition under which the maximum penalized likelihood method is worse than the histogram method is presented. ESA

N88-16160# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
SPECTRAL ANALYSIS OF AN OROGRAPHICALLY STRUCTURED AREA IN THE FOREFIELD OF MESOSCALE FLOW SIMULATIONS [SPEKTRALE ANALYSE EINES OROGRAPHISCH GEGLIEDERTEN GELAENDES IM VORFELD VON MESOSKALIGEN STROEMUNGSSIMULATIONEN] **c47**
Sybilla Schmid *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 103-105 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

Mesoscale wind systems in an orographically structured area were simulated using a suitable input of the orographical data in the flow models. The orogaphical data were smoothed for the simulation in order to save computer time and because the mesoscale model was developed for phenomena with a horizontal extension of 2 km. A spectral analysis using fast Fourier transformation of the original land register allows the estimation of the contribution of the area structures. The harmonic waves, describing the smoothed area, represent the variance of the original area up to 85%. Therefore, the variance was chosen as a measure, since it is proportional to the energy of the wave motion, imposed by the orographical structures in a stable layered atmosphere. ESA

N88-16161# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. Fuer Meteorologie.
OROGRAPHICALLY INFLUENCED COLD FRONTS IN A SPECTRAL APPROACH [OROGRAPHISCH BEINFLUSSTE KALTFRONTEN IN SPEKTRALER BETRACHTUNGSWEISE] **c47**
Robert Stanek *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 106-108 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

A three-dimensional spectral model that takes into account effects of the orography on cold fronts was developed. The front is represented as a cold air flow underneath dynamically passive warm air. The complicated system of equations can be split into a linear and a nonlinear part. The wave solution of the linear part gives the normal modes. The investigation of wave phenomena consists in the determination of instability mechanisms using eigenvalue analysis, and a normal mode initialization. The model is not suited for extensive prognosis calculations. Short term (6 hr) results are already obtained. ESA

N88-16162# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
SIMULATION OF A LEE CYCLOGENESIS USING A NUMERICAL MODEL [SIMULATION EINER LEEZYKLOGENESE MIT EINEM NUMERISCHEN MODELL] **c47**
Arnold Tafferner *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 109-114 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

A numerical simulation method for lee cyclogenesis, used during the international Alpine Experiment is described. The initial data for the isentropic model were prepared starting from the data of 110 radiosonde ascents and an objective analysis model. The situation and intensity of the lee cyclone are correctly forecast. The results reveal the important mechanisms in the lee cyclogenesis: potential vorticity is advected over the Alps, canalization between Alps and Pyrenees, and cold air blocking in the pressure region of the Alps. Geostrophic adaptation forces

dominate the first phase of the cyclogenetic development in the lee. ESA

N88-16163# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
NUMERICAL SIMULATION OF THE FLOW ABOUT NEW ZEALAND [UMSTROEMUNG VON NEUSEELAND NUMERISCHE SIMULATION] **c47**
Wolfgang Ulrich *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 115-119 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

A numerical model for the qualitative study of the atmospheric flow about New Zealand was developed. The three-dimensional model is based on the Boussinesq equations. The model topography for the numerical model is presented. The temperature deviations are plotted. The results show that the numerical model allows a qualitative simulation of the observed phenomena, such as the flow about New Zealand, lee cyclogenesis, flow canalization, as well as the downstream reaching deceleration (blocking) of the flow. ESA

N88-16164# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
CHARACTERISTICS AND CLIMATIC RELEVANCE OF THE ATMOSPHERIC AEROSOL COMPONENTS [DIE ATMOSPHAERISCHEN AEROSOLKOMPONENTEN: CHARAKTERISTIK UND KLIMATISCHE RELEVANZ] **c47**
G. A. dAlmeida *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 121-128 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

The production mechanism and the climate relevance of aerosols were studied from the point of view of their components of different origin. The optical characteristics are illustrated by two important natural aerosol types. Maritime aerosols show an insignificant variability, and scatter completely the incident radiation in a large part of the solar spectral domain. Mineral aerosols show the highest variability and the strongest absorption in the range of the atmospheric window. The direct effects of the particle are especially significant in desert regions. The reduction in cloud alledo is important for cloudy skies, whereby the knowledge of the precise refraction index of the components is required. ESA

N88-16165# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
INVESTIGATIONS OF THE INFLUENCE OF CHEMICAL REACTIONS OF THE VERTICAL FLOW OF GASEOUS AND PARTICULATE COMPOUNDS [UNTERSUCHUNGEN ZUM EINFLUSS CHEMISCHER REAKTIONEN AUF VERTIKALE FLUESSE GAS- UND PARTIKELFOERMIGER VERBINDUNGEN] **c46**
Ralph Dlugi *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 129-134 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

The significance of chemical reactions for the calculation of the dry deposition of atmospheric H2SO4, (NH4)2SO4, HNO3, NH4NO3, NH3, as well as of the total amount of sulfates and nitrates, was investigated. The vertical fluxes and deposition velocities were calculated using the gradient method and the Bowen-ratio method. The effects on the quantities of chemical reactions and several micrometeorological methods for the calculation of the turbulent exchange coefficients, were determined using meteorological mast measurements. The effect of chemical reactions on the vertical fluxes can only be neglected if the transport time is much smaller than the reaction time. The results show that the vertical profiles and hence the grandients and fluxes of reactive compounds in the lower troposphere are affected by chemical reactions with NH3. The vertical gradients and hence the deposition velocities are reduced by 50% to 350% (systematic error at least 50%). ESA

N88-16166# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
NUMERICAL MODELING OF RADIATION FOG [NUMERISCHE MODELLIERUNG VON STRAHLUNGSNEBEL] **c47**
Renate Forkel *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 135-143 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

Model calculations of the time evolution of radiation fog were performed using a one-dimensional model for the atmospheric boundary layer. The prognostic equations of the model are explained. The turbulent exchange was parameterized by a gradient approach. This approach gives simulation results in qualitative agreement with observations. The atmospheric model is coupled with a soil model through flow boundary layer conditions at the Earth's surface resulting in a prognosis of the soil temperature and water content. A comparison of the simulation results with previous measurements shows that the gradient approach for the formulation of the turbulent exchange coefficients using the local Richardson number represents the observed radiation fog structures significantly better than that using a similarity approach. ESA

N88-16167# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
TELESCOPE DESIGN FOR MICHELSON INTERFEROMETER FOR PASSIVE ATMOSPHERIC SOUNDING (MIPAS) B [TELESKOPDESIGN FUER MIPAS-B] **c74**
Chr. Fritzche *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 144-147 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

The design of a telescope for an atmospheric sounder is outlined. The requirements, determining all design options, are given. The preliminary decisions regarding the choice of imaging elements, the number of mirrors, the mirror arrangement, and the form of the mirrors are presented. The optimization of the optical design is explained. The advantages of the system with regard to flexibility, cost reduction, image errors, and blocking of perturbing radiation, are discussed. ESA

N88-16168# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
INVERSION OF SIMULATED SATELLITE SIGNALS [INVERSION VON SIMULIERTEN SATELLITENSIGNALEN] **c32**
Martina Kaestner *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 148-156 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

The inversion of simulated lidar signals from space was investigated. Profiles of atmospheric extinction coefficients were determined from lidar signals with high vertical resolution. The examination of the sensitivity of inversion algorithms for backscatter profiles shows that the otherwise advantageous Klett algorithm has disadvantages if applied to satellite lidar signals. Because the dependence of the extinction profiles on the lidar quotient and the extinction coefficient of the air layer close to the soil is so large, an iterative inversion algorithm was developed. It has a small dependence on a priori unknown quantities. ESA

N88-16169# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
THE ROLE OF ANISOTROPY IN THE LONG RANGE RECONNAISSANCE OF THE ALBEDO OF LAND SURFACES [DIE ROLLE DER ANISOTROPIE BEI DER FERNERKUNDUNG DER ALBEDO VON LANDOBERFLAECHEN] **c43**
Peter Koepke *In its* Research Work at the Meteorological Institute

of the University of Munich (Federal Republic of Germany) Mar. 1987 p 157-160 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

The determination of the albedo of land surfaces, varying in space and time, from radiation density satellite measurements, was investigated. The anisotropy at the radiation field is described by an anisotropy factor, depending on the angles of Sun and satellite in the measuring point. The anisotropy factors spectrally depend on the characteristics of soil and atmosphere. The errors resulting from the assumption that the land surfaces can be treated as isotropic reflectors are discussed. For large land surfaces average anisotropy factors can be measured from satellites. For smaller land surfaces with different types of vegetation, specific anisotropy factors, calculated by numerically simulated radiation density fields, have to be used. ESA

N88-16170# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
RADIATION ABSORPTION IN THE INFRARED SPECTRAL RANGE: A COMPARISON BETWEEN LABORATORY MEASUREMENTS AND THEORETICAL CALCULATION ILLUSTRATED BY A H2O 2.7 MICROMETER [STRAHLUNGSABSORPTION IM INFRAROTEN SPEKTRALBEREICH: VERGLEICH VON LABORMESSUNGEN UND THEORETISCHEN BERECHNUNGEN AM BEISPIEL H2O 2.7 MICROMETER] **c46**
Adalbert Leupolt *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 161-164 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

Infrared transmission measurements in terrestrial and planetary atmospheres were investigated to study the long range reconnaissance of atmospheric parameters. The trace gas water vapor was taken as example. The transmission of water vapor was measured as a function of absorber concentration, pressure, and temperature in the wavelength range between 1 and 100 microns along absorption paths of up to 50 m, using a high resolution two-beam vacuum raster spectrograph with compensation of the self emission of the gas sample. For a direct comparison with experimental data, the monochromatic transmission was calculated from individual line parameters. The agreement between measured and calculated results is excellent. ESA

N88-16171# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
THE ANISOTROPY OF REFLECTED SOLAR RADIATION OVER SEVERAL TYPES OF LAND SURFACE [DIE ANISOTROPIE REFLEKTIERTER SOLARER STRAHLUNG UEBER VERSCHIEDENEN LANDOBERFLAECHENTYPEN] **c43**
Ralf Meerkoetter *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 165-171 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

A set of spectral reflection functions for the description of the most important surface types of the Earth was developed using computer simulations and results of measurements. The developed model is based on a geometrical approach, supposing that the anisotropy in the reflected radiation field of natural surfaces is essentially determined by the geometrical structure of the surface components. The application possibilities of the model are discussed. The results of the model show the superimposed effects of the macro and microstructure on the anisotropy of the reflected radiation. ESA

N88-16172# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
LONG RANGE RECONNAISSANCE OF TRACE GASES: A SPECIAL ASPECT OF EMISSION SPECTROSCOPY [FERNERKUNDUNG VON SPURENGASEN SPEZIELLE ASPEKTE DER EMISSIONSSPEKTROSKOPIE] **c46**
Hermann Oelhaf *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 172-180 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

The sounding of IR absorption lines with high optical thickness of IR-active trace gases in the stratosphere was investigated. The significance of the sensitivity of the radiance, integrated over a line, on changes in the absorber mass, is discussed. The spectral signatures are found to be very sensitive to even small temperature changes. The lines broaden significantly with decreasing minimum height in the stratosphere; the line center is practically independent of the sounded minimum height. A larger absorber mass results in a shift of the emission level towards higher and hence colder layers. The consequences of the above effects on the tangent sounding of stratospheric trace gases are discussed. ESA

N88-16173# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
A BACKSCATTER LIDAR PROPOSED FOR THE SECOND GERMAN SPACELAB MISSION [EIN RUECKSTREULIDAR-VORGESCHLAGEN FUER DIE ZWEITE DEUTSCHE SPACE-LAB-MISSION] **c32**
H. Quenzel *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 181-188 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

A small backscatter lidar suitable for space applications was designed with a view to the German zero gravity D2 mission. The layout and characteristics of the instrument are presented. Estimates of the signal to noise ratio as a function of the backscatter coefficients for several divergences are given. The use of this lidar on a short shuttle mission is ideal to test its measuring possibilities and to assess the required developed time for its operational use on satellites. ESA

N88-16174# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
AN AUREOLAR RADIOMETER FOR THE DETERMINATION OF AEROSOL SIZE DISTRIBUTION [EIN AUREOLENRADIOMETER ZUR BESTIMMUNG DER AEROSOLGROESSENVERTEILUNG] **c35**
Dieter Rabus *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 189-192 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

A radiometer for solar aureolar radiation was developed to determine aerosol size distributions. The requirements for such a radiometer are given. Two engineering difficulties, the necessary dynamic range for the measurement of the radiance and the suppression of perturbing radiation, determine the construction of the instrument within narrow limits. Measurements show that the concept has to be improved regarding the time required for a complete measuring cycle and the absolute calibration procedure. ESA

N88-16175# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
ANTHROPOGENIC EFFECTS ON THE DROPLET FORMATION PROCESS, AND ION CONCENTRATIONS IN DROPLETS [ANTHROPOGENE EINFLUESSE AUF DEN TROPFENBILDUNGSPROZESS UND IONENKONZENTRATIONEN IN TROPFEN] **c47**
Winfried Seidl *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar.

1987 p 193-199 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

The concentration of cloud droplets in several types of cloud and different air masses, including anthropogenically affected urban air masses, was calculated. The applied numerical model describes an adiabatically confined air packet, ascending at constant velocity. The air packet contains aerosol particles whose volume-equivalent radii in dry state are given. The aerosol particles are split into three groups during the droplet formation process. Anthropogenic effects during the droplet formation process are possible, especially during cumulonimbus formation. The ion concentrations in droplets of different size are clearly different, affecting the washing out of trace gases in the clouds. ESA

N88-16176# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
AEROSOL SIZE DISTRIBUTION FROM MEASUREMENTS OF THE RADIANCE IN THE SOLAR AUREOLE [DIE AEROSOLGROESSENVERTEILUNG AUS MESSUNGEN DER STRAHLDICHTE IN DER SONNENAUREOLE] c46
Edith Thomalla *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 200-207 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

It was investigated how the atmospheric aerosol size distribution can be determined from measurements of the radiance in the neighborhood of the Sun and from model calculations. The aerosol scattering function equation was inverted for the numerical determination of the aerosol size distribution. The quality of the inversion results depends on how carefully the measuring parameters, especially wavelength and scattering angle, are selected. The information content of the measured radiance regarding the aerosol size distribution depends largely on these two parameters. The testing of the inversion method using model calculations shows that the aerosol size distribution can be determined with satisfactory quality if the information content of the data is carefully checked and if the radiometer fulfils the specific requirements. ESA

N88-16177# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
COMPUTERIZED EVALUATION OF INTERFEROGRAMS OF THE MICHELSON INTERFEROMETER FOR PASSIVE ATMOSPHERIC SOUNDING (MIPAS) LABORATORY MODEL (LM) [DIE COMPUTERAUSWERTUNG VON INTERFEROGRAMMEN DES MIPAS - LABORMODELLS (LM)] c46
Werner Voelker *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 208-213 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

The software for the evaluation of the MIPAS-LM interferograms is presented. The theory of Fourier spectroscopy is summarized. The MIPAS-LM instrument works as a Fourier spectrometer whose measuring product is an interferogram, fitted into a storage medium in the form of a digitized data set. The interferogram is not symmetrical due the sampling method and the imperfections of the instrument. Therefore, the interferogram has to be corrected using the folding law. Then, after a Fourier transformation, the required spectral information is obtained. ESA

N88-16178# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
THE ITERATIVE RADIANCE MODEL OF THE METEOROLOGICAL INSTITUTE OF THE UNIVERSITY OF MUNICH (WEST GERMANY) [DAS ITERATIVE STRAHLDICHTEMODELL AM MIM] c46
Matthias Wiegner *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 214-220 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

A radiation transport model for the short wavelength spectral range is presented. The model for the radiation field in the system Earth-atmosphere is based on the iterative successive order of scattering method. Thermal radiation is neglected, but multiple scattering is taken into account. The theoretical fundamentals of the one-dimensional (optical thickness is the vertical coordinate) radiation transport model, and its limitations are presented. The model can be used universally, and is programmed to be storage-capacity friendly. The properties of the program and its peripheral programs are outlined. ESA

43 EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N88-16179*# National Aeronautics and Space Administration, Washington, D.C.
COMMERCIAL APPLICATIONS AND SCIENTIFIC RESEARCH REQUIREMENTS FOR THERMAL-INFRARED OBSERVATIONS OF TERRESTRIAL SURFACES
Samuel N. Goward, James V. Taranik, Daniel LaPorte, and Evelyn S. Putnam, ed. (Santa Barbara Research Center, Goleta, Calif.) Aug. 1986 150 p Prepared in cooperation with Maryland Univ., College Park
(NASA-TM-89704; NAS 1.15:89704) Avail: NTIS HC A07/MF A01 CSCL 08B

In the spring of 1986 the EOSAT Company and NASA Headquarters organized a workshop to consider: (1) the potential value of space-acquired multiband thermal remote sensing in terrestrial research and commercial applications, and (2) the scientific and technological requirements for conducting such observations from the LANDSAT platform. The workshop defined the instrument characteristics of three types of sensors that would be needed to expand the use of thermal information for Earth observation and new commercial opportunities. The panels from two disciplines, geology and evapotranspiration/botany, along with the instrument panel, presented their recommendations to the workshop. The findings of these meetings are presented. Author

N88-16180*# GKSS-Forschungszentrum Geesthacht (West Germany).
THEMATIC MAPPER RESEARCH IN THE EARTH SCIENCES: SMALL SCALE PATCHES OF SUSPENDED MATTER AND PHYTOPLANKTON IN THE ELBE RIVER ESTUARY, GERMAN BIGHT AND TIDAL FLATS Progress Report
H. Grassl, R. Doerffer, J. Fischer, C. Brockmann, and M. Stoessel 9 Oct. 1987 40 p Sponsored by NASA
(NASA-CR-182378; NAS 1.26:182378) Avail: NTIS HC A03/MF A01 CSCL 08B

A Thematic Mapper (TM) field experiment was followed by a data analysis to determine TM capabilities for analysis of suspended matter and phytoplankton. Factor analysis showed that suspended matter concentration, atmospheric scattering, and sea surface temperature can be retrieved as independent factors which determine the variation in the TM data over water areas. Spectral channels in the near infrared open the possibility of determining the Angstrom exponent better than for the coastal zone color scanner. The suspended matter distribution may then be calculated by the absolute radiance of channel 2 or 3 or the ratio of both. There is no indication of whether separation of chlorophyll is possible. The distribution of suspended matter and sea surface temperature can be observed with the expected fine structure. A good correlation between water depth and suspended matter distribution as found from ship data can now be analyzed for an entire area by the synoptic view of the TM scenes. J.P.B.

N88-16181# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
TEXTURAL FEATURES FOR IMAGE CLASSIFICATION IN REMOTE SENSING
Vitor Haertel (Universidade Federale do Rio Grand do Sul, Porto Alegre, Brazil) and Yosio Edemir Shimabukuro May 1987 47 p Presented at the 4th Brazilian Symposium on Remote Sensing, Gramado, Brazil, 10-15 Aug. 1986
(INPE-4169-PRE/1066) Avail: NTIS HC A03/MF A01

Texture is an important characteristic in identifying regions of interest in an image. Several methods to quantify image texture were reported in literature. Experiments aimed to extract textural features from digital images by calculating statistical properties in and around each pixel are described. This moving window concept is implemented, and tests using LANDSAT MSS and TM imagery are presented. Author

N88-16182*# Bionetics Corp., Cocoa Beach, Fla.
EFFECTS OF FIRE ON COMPOSITION, BIOMASS, AND NUTRIENTS IN OAK SCRUB VEGETATION ON JOHN F. KENNEDY SPACE CENTER, FLORIDA
Paul A. Schmalzer and C. Ross Hinkle Jul. 1987 149 p
(NASA-TM-100305; NAS 1.15:100305) Avail: NTIS HC A07/MF A01 CSCL 02F

Four stands of oak scrub two, four, eight, and 25 years since fire were sampled with permanent 15 m line transects. Percent cover by species was determined. Plant samples were analyzed for a variety of substances. Transects were resurveyed in 1985 for vegetation parameters. Nutrient pools in biomass were calculated from biomass data and tissue nutrient concentrations. Soil nutrient pools were calculated from nutrient concentrations and bulk density. Species distribution and soil chemical properties were found to be closely related to water table depth. The following fire-related conclusions are reached: (1) major structural changes occur in scrub after fire in that shrub height is reduced and requires four to six years to exceed 1 m; (2) reduction in shrub height affects the suitability of scrub for the Florida scrub jay (3) live biomass increases with time since fire; (4) nutrient concentrations in live biomass do not change with time since fire; (5) species composition and richness are little changed after fire; and (6) imposition of a continued regime of burning on a three-year cycle may have adverse impacts not indicated by the recovery of scrub from a single fire. J.P.B.

N88-16183# Research Inst. of National Defence, Linkoeping (Sweden).
OBJECT DETECTION IN IMAGES FROM OUTDOOR SCENES USING EVIDENTIAL REASONING
Sten Nyberg Aug. 1987 55 p In SWEDISH; ENGLISH summary
(FOA-C-30461-3.3; ISSN-0347-3708; ETN-88-91407) Avail: NTIS HC A04/MF A01; Research Institute of National Defence, Stockholm, Sweden KR 50

Automatic methods for detecting objects in an image were studied. The images were recorded with a charge coupled device camera in the visual range. The features computed are: edge activity, corner presence, area, and shape factor. These features are integrated to a measure indicating probability for detection using evidential reasoning. This is an alternative to common statistical methods when enough a priori knowledge is not available. The result is a probability value for detection for each possible object. ESA

N88-16184# Foersvarets Forskingsanstalt, Stockholm (Sweden).
HIGH RESOLUTION SATELLITE IMAGERY SIMULATION
Ulf Ekblad Jul. 1987 36 p
(PB88-107958; FOA-C-30462-3.3/9.3; ISSN-0347-3708) Avail: NTIS HC A03/MF A01 CSCL 08B

In order to investigate the possibility of using satellites in verifications of military and disarmament treaties, simulations of satellite images are presented. A column of tanks on a road in a terrain model was used as an example of military activities. With the half-width of the PSF (point spread function) as a measure of resolution, the spatial resolution needed for detection was found to be 8m. GRA

N88-16185# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EVALUATION OF THE FLOODING AREAS OF THE SAO GONCALO CANAL THROUGH LANDSAT 5 THEMATIC MAPPER IMAGES [AVALIACAO DA AREA DE INUNDACAO DO CANAL DE SAO GONCALO ATRAVES DE IMAGENS TM-LANDSAT 5]
Carlos Hartmann (Fundacao Univ. do Rio Grande, Brazil), R. A. C. Lamparelli, R. Rosa, and E. E. Sano [1988] 15 p In PORTUGUESE; ENGLISH summary
(INPE-4118-PRE/1039) Avail: NTIS HC A03/MF A01

Two LANDSAT TM images were digitally processed on the I-100 image Analyzer of INPE (Sao Jose dos Campos, Sao Paulo). The floodable area of the canal de Sao Goncalo was studied: one image associated to an exceptionally high inundation (06-11-84) and one image associated with a normal water level (12-04084) were compared. The digital classification (1:50,000 scale) led to a map (1:100,000 scale) showing the limits of the flooding areas. This work demonstrated the usefulness of remote sensing techniques to delimitate and identify floodable areas. Author

N88-16103# Joint Publications Research Service, Arlington, Va.
SATELLITE MONITORING OF EARTHQUAKE PRECURSOR EFFECTS IN MAGNETOSPHERE
Yu. I. Zaytsev *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 106-113 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow, USSR), no. 3, May - Jun. 1987 p 45-50 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16104# Joint Publications Research Service, Arlington, Va.
SPACE APPLICATIONS IN GEOGRAPHY
A. M. Grin *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 114-124 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 19-25 (For primary document see N88-16063 08-42)
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N88-16105# Joint Publications Research Service, Arlington, Va.
METHOD FOR JOINT ADJUSTMENT OF SATELLITE AND SURFACE GEODETIC NETWORKS Abstract Only
B. M. Klenitskiy, K. K. Nasretdinov, and M. M. Khotin *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 125 Transl. into ENGLISH from Geodeziya i Kartografiya (Moscow, USSR), no. 5, May 1987 p 12-15 (For primary document see N88-16063 08-42)
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N88-16108# Joint Publications Research Service, Arlington, Va.
SPACE PHOTOGRAPHS OF THE ONEGA-LADOGA ISTHMUS AND PREDICTION OF USEFUL MINERALS
Z. A. Bagrova and I. B. Antonova *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 128 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 66-72 Original language document was announced in IAA as A87-48185 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16109# Joint Publications Research Service, Arlington, Va.
USE OF SPACE PHOTOGRAPHS FOR GEOMORPHOLOGICAL STUDIES IN SOUTHWESTERN TAJIKISTAN
V. P. Loziyev and M. S. Saidov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 129 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 73-80 Original language document was announced in IAA as A87-48186 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16110# Joint Publications Research Service, Arlington, Va.
USE OF SPACE PHOTOGRAPHS FOR PALEOSEISMO-GEOLOGICAL STUDIES (ON THE EXAMPLE OF MONGOL-IAN ALTAY) Abstract Only
A. L. Strom *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 130 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 81-84 Original language document was announced in IAA as A87-48187 (For primary document see N88-16063 08-42)
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N88-16111# Joint Publications Research Service, Arlington, Va.
STUDY OF RELIEF OF ORE REGIONS USING SPACE IMAGES (ON THE EXAMPLE OF EASTERN YAKUTIA) Abstract Only
V. A. Balandin *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 131 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 85-89 Original language document was announced in IAA as A87-48188 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16112# Joint Publications Research Service, Arlington, Va.
STATISTICAL MODEL OF INTERACTION OF ELECTROMAG-NETIC WAVES WITH NATURAL OBJECTS BEING SENSED Abstract Only
V. V. Yegorov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 132 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 90-95 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16113# Joint Publications Research Service, Arlington, Va.
MONTE CARLO METHOD CALCULATION OF SPECTRAL BRIGHTNESS COEFFICIENT OF VEGETATION COVER AS FUNCTION OF ILLUMINATION CONDITIONS Abstract Only
Yu. K. Ross and A. L. Marshak *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 133 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 96-105 Original language document was announced in IAA as A87-48190 (For primary document see N88-16063 08-42)
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N88-16115# Joint Publications Research Service, Arlington, Va.
MULTISTEP COMPONENT ANALYSIS OF CORRELATIONS Abstract Only
V. A. Kottsov and E. A. Gorbushina *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 135 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 118-122 Original language document was announced in IAA as A87-48193 (For primary document see N88-16063 08-42)
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N88-16116# Joint Publications Research Service, Arlington, Va.
NEW POSSIBILITIES FOR USING GRAVITY DATA IN DEVELOPING GEODETIC COORDINATE SYSTEMS Abstract Only
L. P. Pellinen *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 136 Transl. into ENGLISH from Geodeziya i Kartografiya (Moscow, USSR), no. 3, Mar. 1987 p 10-13 Original language document was announced in IAA as A87-42939 (For primary document see N88-16063 08-42)
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N88-16133# Joint Publications Research Service, Arlington, Va.
ACADEMIC COURSE SPACE METHODS FOR STUDYING MODERN LANDSCAPES OF CONTINENTS
Ye. V. Glushko *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 41 Transl. into ENGLISH from Vestnik Moskovskogo Universiteta: Seriya 5, Geografiya (Moscow, USSR), no. 6, Nov. - Dec. 1986 p 78-82 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16135# Joint Publications Research Service, Arlington, Va.
PHOTOGRAMMETRIC PRINCIPLES FOR COMBINING REMOTE SOUNDING AND THREE-DIMENSIONAL MAPPING Abstract Only
O. R. Musin, B. A. Novakovskiy, and S. N. Serbenyuk *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 42-43 Transl. into ENGLISH from Vestnik Moskovskogo Universiteta: Seriya 5, Geografiya (Moscow, USSR), no. 6, Nov. - Dec. 1986 p 56-64 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16136# Joint Publications Research Service, Arlington, Va.
LASER SYSTEM FOR AUTOMATING TOPOGRAPHIC TERRAIN SURVEY Abstract Only
V. S. Golov, Yu. M. Desyatykh, A. S. Fedorov, and A. G. Paramonov *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 47 Transl. into ENGLISH from Geodeziya i Kartografiya (Moscow, USSR), no. 10, Oct. 1986 p 38-41 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16143# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
USE OF THE THERMODYNAMIC EVAPORATION FORMULA OF HOFFMANN IN ENERGY BALANCE MODELS FOR FLOWING WATER [DIE ANWENDUNG DER THERMODYNAMISCHEN VERDUNSTUNGSFORMEL NACH HOFMANN IN ENERGIE-BILANZMODELLEN VON FLIESSGEWAESSERN]
Norbert Beier *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 10-17 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16145# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
ENERGY BALANCE AND DISCHARGE OF AN ALPINE GLACIER, ILLUSTRATED BY MOUNT VERNAGTFERNER IN THE OETZAL ALPS, TYROL [ENERGIEBILANZ UND ABFLUSS EINES ALPENGLETSCHERS DARGESTELLT AM BEISPIEL DES VERNAGTFERNERS IN DEN OETZTALER ALPEN/TIROL]
Heidi Escher-Vetter *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 24-29 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16147# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
THE UNSTEADY GROUND HEAT FLOW AT THE CONTACT SURFACE BETWEEN A GLACIER RUN AND THE SUBSOIL [DER INSTATIONAERE BODENWAERMESTROM AN DER KONTAKTFLAECHE EINES GLETSCHERBACHES ZUM UNTERGRUND]
Waldemar Gereke *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 37-42 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16169# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
THE ROLE OF ANISOTROPY IN THE LONG RANGE RECONNAISSANCE OF THE ALBEDO OF LAND SURFACES [DIE ROLLE DER ANISOTROPIE BEI DER FERNERKUNDUNG DER ALBEDO VON LANDOBERFLAECHEN]
Peter Koepke *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 157-160 In GERMAN (For primary document see

N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16171# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
THE ANISOTROPY OF REFLECTED SOLAR RADIATION OVER SEVERAL TYPES OF LAND SURFACE [DIE ANISOTROPIE REFLEKTIERTER SOLARER STRAHLUNG UEBER VERSCHIEDENEN LANDOBERFLAECHENTYPEN]
Ralf Meerkoetter *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 165-171 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16305# Ministry of Transport and Waterways, The Hague (Netherlands). Tidal Waters Div.
NATIONAL REMOTE SENSING PROGRAM (NRSP) OF THE NETHERLANDS
D. Spitzer *In* ESA, Ocean Colour Workshop Jul. 1987 p 83-90 Sponsored by the Netherlands Remote Sensing Board, the National Aerospace Lab. and Netherlands Inst. for Sea Research Original contains color illustrations (For primary document see N88-16292 08-48)
Copyright Avail: NTIS HC A06/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *28 Propellants and Fuels.*

N88-16186# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Lab. Associado de Sensores e Materiais.
A FLUX ANALYSIS OF THE SOLAR CELLS
Ram Kishore Jul. 1987 18 p Presented at the 8th Brazilian Congress of Vacuum Applications in Industry and Science, Rio de Janeiro, Brazil, 22-24 Jul. 1987
(INPE-4247-PRE/1120) Avail: NTIS HC A03/MF A01

A flux method for the analysis of the excess carrier transport in multiple layer solar cells is described. This method avoids the assumption of the usual macroscopic device theory that the physical dimension of the system should be large compared with the mean free path of the excess carrier. In this analysis the macroscopic current is described in terms of the microscopic parameters of the excess carrier like mean free path, mean lift time, and mean thermal velocity. The general formalism, presented here, can be applied to almost any type of solar cell structure. In the appropriate limits, the results of this formalism are shown to reduce to those obtained by earlier restricted analysis. Author

N88-16187# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
A PROPOSED METRIC FOR ASSESSING THE POTENTIAL OF COMMUNITY ANNOYANCE FROM WIND TURBINE LOW-FREQUENCY NOISE EMISSIONS
N. D. Kelley Nov. 1987 11 p Presented at Windpower '87, San Francisco, Calif., 5 Oct. 1987
(Contract DE-AC02-83CH-10093)
(DE88-001113; SERI/TP-217-3261; CONF-871062-8) Avail: NTIS HC A03

Given our initial experience with the low frequency, impulsive noise emissions from the MOD-1 wind turbine and their impact on the surrounding community, the ability to assess the potential of interior low frequency annoyance in homes located near wind turbine installations may be important. Since there are currently no universally accepted metrics or descriptors for low frequency community annoyance, we performed a limited program using volunteers to see if we could identify a method suitable for wind turbine noise applications. We electronically simulated three interior environments resulting from low frequency acoustical loads radiated from both individual turbines and groups of upwind and downwind turbines. The written comments of the volunteers exposed to these interior stimuli were correlated with a number of descriptors which have been proposed for predicting low frequency annoyance. The results are presented in this paper. We discuss our modification of the highest correlated predictor to include the internal dynamic pressure effects associated with the response of residential structures to low frequency acoustic loads. Finally, we outline a proposed procedure for establishing both a low frequency figure of merit for a particular wind turbine design and, using actual measurements, estimate the potential for annoyance to nearby communities. DOE

N88-16188# Research Inst. of National Defence, Stockholm (Sweden).
OPTIMAL CONTROL OF WINDPOWERED PLANTS
Bjoern Jakobsson Aug. 1987 13 p In SWEDISH, ENGLISH summary
(FOA-C-20610-2.7; ISSN-0347-3694; ETN-88-91398) Avail: NTIS HC A03/MF A01

A model of the plant consisting of two masses: the turbine wheel itself plus the generator with a gearbox was investigated. The aerodynamic moment was linearized with an optimal yaw angle. This optimal control theory is based on the control of the electrical torque. A linear-quadratic regulator instead of a quadratic one was studied to better follow the wind variations. But energy production is not improved to the same degree. The control signals are more powerful and the axle moment is higher during the changes of wind velocities. The duration of these periods is 15 to 20 sec, during which energy production is not satisfactory. If this period of stabilization is considered to be too long, this project must be abandoned. ESA

N88-16189# Technische Univ., Berlin (West Germany). Inst. of Aerospace.
DEFINITION AND ECONOMIC EVALUATION OF SPACE SOLAR POWER SYSTEMS (SSPS), PART 1
H. H. Koelle, K. Sputek, and M. Schulze 15 Aug. 1987 37 p
(ILR-Mitt-184-1(1987); ETN-88-91444) Avail: NTIS HC A03/MF A01

A life cycle model of a typical space power system (SPS) in the first half of the next century is described. Inputs for this logistics model are: life cycle duration (100 yr); power level of the SPS at the end of life cycle assumed (500 GW); power level for single SPS unit (5 GW); availability of space power units (90 %); and specific mass (Mg/MW) of SPS as a function of time. A system of 100 operating space power units in geostationary orbit with an output of 500 GW in its 50th year requires in this year a total mass flow of 200,000 T. To operate the system, a crew size in GEO is 600 people. The total mass installed in the SPS is 6 million metric tons. To transport this material to the GEO from Earth and from the Moon, average annual launch rates of 300 for the lunar bus and 340 for the heavy lift launch vehicle during the 50 yr time period are required. The average annual output of the SPS is economically attractive: 2188 TWh at 7.4 mills/kWh. ESA

N88-16190# Technische Univ., Berlin (West Germany). Inst. of Aerospace.
DEFINITION AND ECONOMIC EVALUATION OF SPACE SOLAR POWER SYSTEMS (SSPS), PART 2
H. H. Koelle, K. Sputek, and M. Schulze 15 Aug. 1987 79 p
(ILR-Mitt-184-2(1987); ETN-88-91445) Avail: NTIS HC A05/MF A01

A life cycle model of a typical space power system (SPS) in the first half of the next century is described. Inputs for this logistics model are: life cycle duration (100 yr); power level of the SPS at the end of life cycle assumed (500 GW); power level for single SPS unit (5 GW); availability of space power units (90 %); and specific mass (Mg/MW) of SPS as a function of time. The simulation

model comprises 171 equations describing the interrelationships between the system variables and parameters. The computer code developed for this simulation model is available upon request. The printouts of all system variables calculated as functions of time are presented. ESA

N88-16191# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ACTUAL PERFORMANCE AND ECONOMIC FEASIBILITY OF RESIDENTIAL SOLAR WATER HEATERS Final Report
Jorgdieter Anhalt and Sergio Augusto Weige Ennes Sep. 1987 19 p Presented at the 4th Congress of Energy, Rio de Janeiro, Brazil, 1987
(Contract CESP-903.00.922-0.00171)
(INPE-4399-RPE/555) Avail: NTIS HC A03/MF A01

Four residential water heaters currently available on the Brazilian market have been evaluated for their possible use in substituting for the common electric shower head. The tests were carried out with the solar systems mounted side by side on an artificial roof. The hot water demand was simulated following a consumer profile which represents an average Brazilian family. The data, which was collected automatically and presented in the form of graphs and tables, shows that an optimized solar water heater could save as much as 65 percent of the energy demand for residential water heating in the state of Sao Paulo. A study concludes that the installation and maintenance of such a solar system are economically feasible if long term financing is available. Author

45 ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

N88-16192# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
LONG-TERM VARIATION OF TOTAL OZONE
R. P. Kane Aug. 1987 25 p Submitted for publication
(Contract FINEP-537/CT)
(INPE-4307-PRE/1173) Avail: NTIS HC A03/MF A01

The long-term variation of total ozone is studied for 1957 up to date for different latitude zones. The 3-year running averages show that, apart from a small portion showing parallelism with sunspot cycles, the trends in different latitude zones are dissimilar. In particular, where northern latitudes show a rising trend, the southern latitudes show an opposite (decreasing) trend. In the north-temperature group, Europe, North America, and Asia show dissimilar trends. The longer data series (1932 onwards) for Arosa shows, besides a solar-cycle-dependent component, a steady level during 1932-1953 and a down-trend thereafter, up to date. Very localized but long-lasting circulation patterns, different in different geographical regions, are indicated. Author

N88-16193# State Univ. of New York, Albany. Research Foundation.
RESEARCH PROJECT ON CO-INDUCED CLIMATE CHANGE
R. D. Cess and S. Hameed Nov. 1987 45 p
(Contract DE-FG02-85ER-60314)
(DE88-002352; DOE/ER-60314/3) Avail: NTIS HC A03/MF A01

The report presents summaries of progress in the following areas; (1) narrow and broad band measurement of the planetary albedo: conversion simulation with a general circulation model; (2) exploratory studies of cloud radiative forcing with a general circulation model; (3) diurnal variability of the planetary albedo; and (4) atmospheric climate feedback processes compared within general circulation models. DOE

N88-16194# Argonne National Lab., Ill.
A REVIEW OF METHANOL VEHICLES AND AIR QUALITY IMPACTS
D. Moses and C. Saricks 1987 7 p Presented at the International Fuels and Lubricants Meeting and Exposition, Toronto, Ontario, 2 Nov. 1987
(Contract W-31-109-eng-38)
(DE88-002846; CONF-871142-6) Avail: NTIS HC A02/MF A01

In the quest for measures to reduce ambient ozone and carbon monoxide levels to the degree required by revised State Implementation Plans (SIPs), non-attainment areas are investigating and committing to incentive programs for accelerated penetration of methanol- and flexible-fueled motor vehicles into the regional fleet. In this paper we examine if the premises for these commitments are sound; if, in fact, incontrovertible evidence is in hand to assure that the net air quality effect of replacing gasoline- and diesel-powered vehicles with methanol- and flexible-fuel units will be positive; and whether such positive effects, even if they can be proved, will occur in a time frame that will be useful or even relevant to the developers of SIP revisions. Our conclusions, based upon emission rate and failure mode information now available, are that optimism on either front (net positive air quality effect or availability of production methanol-compatible units in the near term) is premature, and that the case for methanol today should probably be founded on the desirability of national energy security, rather than on any assumed local or regional environmental benefit needed for SIP compliance. DOE

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N88-16195*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ALOUETTE-ISIS PROGRAM SUMMARY
John E. Jackson Aug. 1986 95 p
(NASA-CR-180747; NAS 1.26:180747;
NSSDC/WDC-A-R/S-86-09) Avail: NTIS HC A05/MF A01 CSCL 04A

The Alouette-ISIS program was a joint undertaking between Canada and the United States. Canada provided the Alouette and ISIS spacecraft, data acquisition, and satellite control. The USA provided launch capability, satellite tracking, and data acquisition. Brief descriptions of the six spacecraft and of the investigations on each spacecraft are given. The Alouette-ISIS bibliography, order alphabetically by first author's name, is contained. B.G.

N88-16196# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
SOLAR TIDES IN THE UPPER EQUATORIAL THERMOSPHERE: A COMPARISON BETWEEN AE-E DATA AND THE NCAR THERMOSPHERIC GENERAL CIRCULATION MODEL M.S. Thesis
Mark F. Storz 1987 33 p
(AD-A186160; AFIT/CI/NR-87-113T) Avail: NTIS HC A03/MF A01 CSCL 04A

Numerical calculations of the equatorial thermospheric tidal temperatures and densities are compared with mass spectrometer data from the Atmosphere Explorer-E SATELLITE (AE-E) for solar minimum solstice conditions. The model calculations were made using the National Center for Atmospheric Research thermospheric general circulation model (TGCM), which includes the effects of viscosity, conductivity, diffusion, ion drag, winds, and temperature gradients. The thermospheric diurnal and semidiurnal tides are excited in situ by solar heating and by ion-neutral momentum coupling. The semidiurnal tidal calculations also include the effects of upward propagating waves generated by heating in the lower atmosphere. The semidiurnal propagating component is modeled by use of the classical tidal perturbations as lower boundary conditions. The model has been tuned by adjusting the propagating tidal forcing term until calculated semidiurnal winds and temperature fields best approximate incoherent scatter observations. The TGCM reproduces the gross tidal features, including the nighttime maxima. The largest discrepancy is the relative weakness of the model's

diurnal amplitudes. This may be due to uncertainties in the EUV heating rates and thermospheric cooling rates. On the other hand, the model semidiurnal density amplitudes are considerably larger than those of the data. The terdiurnal amplitudes match fairly well, but the data exhibit a great asymmetry about the geographic equator. GRA

N88-16197*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
NONLINEAR, RELATIVISTIC LANGMUIR WAVES IN ASTROPHYSICAL MAGNETOSPHERES
Abraham C.-L. Chian Sep. 1987 19 p Presented at the Spring College on Radiation in Plasmas, Trieste, Italy, May 1987 Submitted for publication
(Grant NsG-7341)
(NASA-CR-182422; NAS 1.26:182422; INPE-4395-PRE/1215)
Avail: NTIS HC A03/MF A01 CSCL 04A

Large amplitude, electrostatic plasma waves are relevant to physical processes occurring in the astrophysical magnetospheres wherein charged particles are accelerated to relativistic energies by strong waves emitted by pulsars, quasars, or radio galaxies. The nonlinear, relativistic theory of traveling Langmuir waves in a cold plasma is reviewed. The cases of streaming electron plasma, electronic plasma, and two-streams are discussed. Author

N88-16198# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MULTISPECTRAL OPTICAL OBSERVATIONS OF IONOSPHERIC F-REGION STORM EFFECTS AT LOW LATITUDE
Y. Sahai, J. A. Bittencourt, H. Takahashi, N. R. Teixeira, J. H. A. Sobral, B. A. Tinsley, and R. P. Rohrbaugh (Texas Univ. at Dallas, Richardson.) Aug. 1987 30 p Presented at the SBPC Meeting, Brasilia, Brazil, Jul. 1987
(Contract FINEP-537/CT; Grant NSF INT-82-02410)
(INPE-4231-PRE/1105) Avail: NTIS HC A03/MF A01

Simultaneous measurements of the OI 7774 and 6300 A, N2(+) 3914 A, and H sub Beta 4861 A nightglow emissions, were carrried out at Cachoeira Paulista, since 1982, to study the response of the low latitude ionospheric F-region to magnetic storms. The observations obtained during three magnetic storms are presented and discussed. The N2(+) 3914 A and H sub beta 4861 A emissions excited by energetic particle precipitation were observed during the main phase of strong magnetic storms. In contrast to the observations reported from mid-latitude stations by other investigators, no enhancements in the OI 7774 A emission due to energetic particle precipitations were evident at this latitude. Even during the strong magnetic storms, the OI 7774 A intensity variations observed followed the variation of (F sub 0 F2)sup 4, in agreement with the recombination excitation mechanism. The OI 6300 A emission, on August 7 to 8 and March 28 to 29, showed periodic intensity variations, which are associated with vertical oscillations of the ionospheric F-region seen from the ionograms obtained at the same location. Also, the OI 6300 A, north-south scanning observation on one occasion showed no meridional and longitudinal phase change, indicating the absence of propagation. Author

N88-16199# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
FTE LIKE VARIATIONS IN THE GEOMAGNETIC FIELD AT GROUND BASED CONJUGATE STATIONS IN THE CUSP REGIONS
Nalin B. Trivedi, L. J. Lanzerotti, A. Wolf, C. G. Maclennan, and L. Medford (Bell Telephone Labs., Inc., Murray Hill, N. J.) Sep. 1987 16 p Presented at the 39th Annual Meeting of the SBPC, Brasilia, Brazil, Jul. 1987
(Contract FINEP-537/CT)
(INPE-4345-PRE/1182) Avail: NTIS HC A03/MF A01

Magnetic field data acquired at the conjugate pair stations Frobisher Bay/South Pole were carefully studied to examine the nature of the magnetic signatures identified as possible ionospheric signatures of flux transfer events (FTEs). It was found, in an examination of data over the interval July-November 1985, many events, covering a wide range of amplitudes, that are suggestive of intense field-aligned currents convected over the observing stations. All the events were found to have a half-width in time of a few minutes and to be conjugate. All of the events have vertical magnetic field perturbations which imply field-aligned currents in the same direction (either into or out of the ionosphere) in both hemispheres. The implications of these results for the identification of these events with FTEs and contemporary models for dayside reconnection and field-aligned systems will be discussed. Author

N88-16200*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CRITERIA OF INTERPLANETARY PARAMETERS CAUSING INTENSE MAGNETIC STORMS (Dst LESS THAN -100nT)
Walter D. Gonzalez and Bruce T. Tsurutani (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) Aug. 1987 23 p Submitted for publication Sponsored by NASA, Pasadena, Calif. and National Academy of Sciences - National Research Council, Washington, D.C.
(NASA-CR-182423; NAS 1.26:182423; INPE-4306-PRE/1172)
Avail: NTIS HC A03/MF A01 CSCL 04A

Ten intense storms occurred during the 500 days of August 16, 1978 to December 28, 1979. From the analysis of ISEE-3 field and plasma data, it is found that the interplanetary cause of these storms are long-duration, large and negative IMF B sub Z events, associated with interplanetary duskward-electric fields greater than 5 mV/m. Because a one-to-one relationship was found between these interplanetary events and intense storms, it is suggested that these criteria can, in the future, be used as predictors of intense storms by an interplanetary monitor such as ISEE-3. These B sub Z events are found to occur in association with large amplitudes of the IMF magnitude within two days after the onset of either high-speed solar wind streams or of solar wind density enhancement events, giving important clues to their interplanetary origin. Some obvious possibilities will be discussed. The close proximity of B sub Z events and magnetic storms to the onset of high speed streams or density enhancement events is in sharp contrast to interplanetary Alfven waves and HILDCAA events previously reported, and thus the two interplanetary features corresponding geomagnetic responses can be thought of as being complementary in nature. An examination of opposite polarity B sub Z events with the same criteria show that their occurrence is similar both in number as well as in their relationship to interplanetary disturbances, and that they lead to low levels of geomagnetic activity. Author

N88-16201# European Space Agency, Paris (France).
PROCEEDINGS OF THE 8TH ESA SYMPOSIUM ON EUROPEAN ROCKET AND BALLOON PROGRAMS AND RELATED RESEARCH
T. D. Guyenne, ed. and J. J. Hunt, ed. Aug. 1987 481 p Partly in FRENCH and ENGLISH Symposium held in Sunne, Sweden, 17-23 May 1987; sponsored by ESA and Swedish Space Corp.
(ESA-SP-270; ISSN-0379-6566; ETN-88-91133) Copyright
Avail: NTIS HC A21/MF A01

Research using the Swedish Viking satellite; ground-based instruments and observations related to rockets, balloons, and STS; middle atmosphere physics; balloon and rocket ranges; aurora and airglow/ionospheric physics; ionosphere/magnetosphere interactions; solid Earth investigations using balloon-borne instruments; astrophysics; material sciences; and life sciences were discussed. For individual titles, see N88-16202 through N88-16278.

N88-16202# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Space Dept.
THE GERMAN SCIENTIFIC BALLOON AND SOUNDING ROCKET PROGRAM
A. F. Dahl and M. Otterbein (Bundesministerium fuer Forschung und Technologie, Bonn, West Germany) *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 9-17 (For

primary document see N88-16201 08-46)
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Sounding rocket projects in astronomy, aeronomy, magnetospheric research, material sciences, and life sciences under microgravity are described. Balloon projects in astronomy and aeronomy are presented. Satellite projects including AMPTE, SOHO, Cluster, San Marco-D, HELIOS, Giotto, Ulysses, CRAF, ISOPHOT, Rosat, and the Gamma Ray Observatory are mentioned. ESA

N88-16203# Centre National d'Etudes Spatiales, Paris (France).
THE FRENCH BALLOON AND SOUNDING ROCKET SPACE PROGRAM [LE PROGRAMME FRANCAIS DE RECHERCHE SPATIALE EN BALLONS ET EN FUSEES-SONDES]
S. Coutin/Faye and I. Sadourny *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 19-22 In FRENCH (For primary document see N88-16201 08-46)
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Stratospheric and long duration flight balloon programs are outlined. Open stratospheric balloons up to 1 million cu m volume are used to carry astronomy, solar system, aeronomy, stratosphere, biology, space physics, and geophysics experiments. The long duration balloons can carry 50 kg payloads at 20 to 30 km altitude for 10 days to several weeks. Pressurized stratospheric balloons, and infrared hot air balloons are used. They are used to study the dynamics of stratospheric waves and atmospheric water vapor. Laboratories participating in sounding rocket programs are listed. ESA

N88-16204# Royal Norwegian Council for Scientific and Industrial Research, Oslo. Space Activity Div.
THE NORWEGIAN SCIENTIFIC BALLOON AND SOUNDING ROCKET PROGRAM 1987-1990
A. Gundersen *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 23-26 (For primary document see N88-16201 08-46)
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Investigations of the polar upper atmosphere and the study of ionospheric/magnetospheric processes using rockets, balloons, and satellites, together with ground-based techniques are outlined. Magnetospheric and ionospheric physics; modification experiments in the polar ionosphere; and processes and dynamics of the neutral atmosphere at high latitudes are studied. The aims, instrumentation, payload, and organization of rocket programs are listed. ESA

N88-16205# Swedish Space Corp., Solna.
THE SWEDISH SOUNDING ROCKET AND BALLOON PROGRAM
K. Lundahl *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 27-30 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

Sounding rocket and balloon investigations for atmosphere, astrophysics, and microgravity research are described. Magnetosphere and ionosphere physics, including measurements of charged particles and electrical and magnetic fields; upper atmosphere physics and chemistry, including studies of the composition of the atmosphere at altitudes of 80 to 150 km; astrophysics, comprising studies of stars and galaxies in the UV and IR; and material and fluid science in microgravity, comprising experiments in solidification of alloys and diffusion processes in liquid metals are covered. Developments in attitude control, telemetry, and long duration sounding rockets are outlined. Infrared observations of the interstellar medium, and studies on nitrogen-oxygen photochemistry and transport in the upper atmosphere are planned. Studies on auroral electrodynamics are proposed and investigation of the structure and dynamics of the middle atmosphere above the northern polar region during summer is discussed. ESA

N88-16206# Bern Univ. (Switzerland). Inst. fuer Physik.
SWISS SCIENTIFIC BALLOON AND SOUNDING ROCKET EXPERIMENTS 1985-1987
E. Kopp *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 31-33 (For primary document see N88-16201 08-46)
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Rocket and balloon investigations concerning the chemistry and composition of the middle atmosphere, astrophysics (Sun, stars, planets, interstellar gas) and life sciences are presented. Sky surveys, satellite navigation, solar and cosmic radiation, and stratospheric ion composition payloads are described. Microwave ozonometry and water vapor radiometry from an aircraft is mentioned. ESA

N88-16207# Swedish Board for Space Activities, Solna.
VIKING: THE FIRST SWEDISH SATELLITE
K. Fredga *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 37-39 (For primary document see N88-16201 08-46)
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The Swedish Viking satellite was designed to study space plasma phenomena, particularly processes producing auroras, near the Earth and in the ionosphere and magnetosphere. It studies auroral particle acceleration regions; sources of auroral particles; energy transfer in the magnetosphere; kilometer waves; and polar cap arcs. Instruments include an ultraviolet imager, plasma probes, and a flux gate magnetometer. ESA

N88-16208# Calgary Univ. (Alberta). Dept. of Physics.
GLOBAL VIEWS OF THE AURORA FROM THE VIKING SATELLITE
C. D. Anger and J. S. Murphree *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 41-44 Sponsored by the Canadian Natural Sciences and Engineering Research Council (For primary document see N88-16201 08-46)
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The ultraviolet imager on the Viking satellite provided global image sequences of the aurora in dayside and nightside hemispheres with high spatial and temporal resolution. Onset and development of auroral substorms and the occurrence of small scale auroral brightenings were observed in the context of the global auroral distribution. Examples of substorm behavior which show multiple intensifications existing in the auroral distribution as well as the dominance of poleward and eastward evolution of substorms in contrast to westward motion are presented. ESA

N88-16209# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Physics.
INSTANTANEOUS PICTURES OF THE HIGH-LATITUDE ELECTRODYNAMICS USING VIKING AND DMSP/F7 OBSERVATIONS
G. T. Marklund, L. G. Blomberg, D. A. Hardy, and F. J. Rich (Air Force Geophysics Lab., Hanscom AFB, Mass.) *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 45-50 Sponsored by the Swedish Board for Space Activities (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

Simultaneous observations by the Viking and the DMSP/F7 satellites were applied to a technique to obtain realistic pictures of the auroral electrodynamics. An instantaneous global equipotential pattern is calculated using field-aligned current and conductivity distributions that are qualitatively consistent with the Viking auroral imager data, and quantitatively consistent with magnetic field and particle data from the two satellites. This convection pattern agrees with the E x B-drift vectors estimated from Viking electric field data. Discrepancies consistent with upward parallel electric fields occur in regions of upward currents. The pattern is of the normal two-cell type, with a small dusk cell and

a large, elongated crescent-shaped dawn cell. The excellent agreement between the satellite and model data demonstrates the reliability of the results. ESA

N88-16210# Kiruna Geophysical Inst. (Sweden). Swedish Inst. of Space Physics.
CHARACTERISTICS OF PARTICLE ACCELERATION AT HIGH LATITUDE
L. Eliasson *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 51-54 Sponsored by the Swedish Board for Space Activities (For primary document see N88-16201 08-46)
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The Swedish Viking investigated the particle acceleration and heating in the polar cap. Polar arcs are observed in regions, most likely on closed magnetic field lines, with signatures of field-aligned acceleration. The electron distributions have characteristics similar to those in the plasma sheet boundary layer. High latitude arcs are frequently located at the poleward edge of an expanded auroral oval, reaching 90 deg invariant latitude during quiet magnetic conditions. Observations of low energy bidirectional electron beams at high latitude are presented. ESA

N88-16211# Kiruna Geophysical Inst. (Sweden). Swedish Inst. of Space Physics.
FIRST RESULTS FROM THE VIKING ASSOCIATED AURELD-VIP ROCKET AND EISCAT CAMPAIGN
I. Sandahl, A. Steen, A. Pellinen-Wannberg, B. Holback, F. Soeraas, and J. S. Murphree (Calgary Univ., Alberta) *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 55-60 (For primary document see N88-16201 08-46)
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Auroral acceleration and precipitation mechanisms were studied by performing measurements in the ionosphere in conjunction with the satellite Viking. Two rockets were launched to reach apogee as the magnetic foot point of Viking passed the rocket magnetic latitude. The first launch took place on Nov 4 at 2044:01 UT into a very broad and large auroral oval. The second rocket was launched on Dec 12 at 2021:36 UT at the poleward edge of an auroral arc. In both cases real time images from Viking were used to determine whether there was aurora in the path of the rocket. In the Nov 4 launch EISCAT was operated in a special Aureld-VIP mode. Electric field, magnetic field, and plasma measurements are shown. ESA

N88-16212# Bergen Univ. (Norway). Dept. of Physics.
REPORT ON GROUND-BASED ACTIVITY AT ANDOYA (NORWAY) IN RELATION TO THE AURELD-VIP HIGH ROCKET AND TO THE VIKING SATELLITE
F. Soeraas, K. Aarsnes, K. Broenstad, M. Haavaag, and V. Opalic *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 61-64 Sponsored by the Royal Norwegian Council for Scientific and Industrial Research, and NAVF, Norwegian Research Council (For primary document see N88-16201 08-46)
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A ground based campaign was instigated to obtain simultaneous ground based measurements with the Aureld-VIP High rocket and the Swedish Viking satellite, and to test and improve a real time instrument for recording and displaying spectral information on magnetic micropulsation. Particle measurements performed in the rocket are compared with measurements in the satellite and on the ground. During the rocket flight, Pc1 micropulsations are observed at the rocket range, and similar variations are detected in the electron countrate measured in the rocket. The micropulsations are attributed to electrons changing conductivity at electrojet altitudes. ESA

N88-16213# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
BALLOON MEASUREMENT OF MAGNETIC FIELD DURING SUBSTORMS IN AURORAL ZONE
J. P. Treilhou, J. Coutelier, A. Saint-Marc, S. Trabelsi, A. Cros, and I. Dandouras *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 65-69 (For primary document see N88-16201 08-46)
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Balloon measurements of the magnetic field in the northern auroral zone are presented. The vertical component observed during the SAMBO-79 balloon campaign is compared with the ground observations of the 4 Mar., 1979 substorm. The horizontal and vertical components observed during the BOA-Viking balloon campaign for the 26 July 1986 substorm are shown. Expected signatures at balloon altitudes are discussed for horizontal line or sheet currents, and transverse Alfven waves. ESA

N88-16214# Washington Univ., Seattle. Geophysics Program.
AURORAL X-RAY IMAGES DURING A PULSATION EVENT
S. H. Werden and G. K. Parks *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 71-77 (For primary document see N88-16201 08-46)
(Contract N00014-85-K-0391; Grant NSF ATM-84-20220)
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The morphology of an auroral event observed in July 1986 at Kiruna (Sweden) is studied using an X-ray imager. The X-ray event started at 2300 UT (100 LT) and lasted 1 hr. The event was characterized by a short period (5 to 15 sec) modulation superposed upon a longer period modulation (several minutes). The shorter period modulation identifies this as a pulsating aurora. Examination of the spectral and spatial characteristics of this event reveals that the amount of spatial structure of the precipitation region depends on the spectrum of the X-rays, a softer spectrum is associated with more spatial structure. A northward motion of the X-ray source region concurrent to the polarity change in the Z-component of the magnetic field is observed. ESA

N88-16215# Oesterreichische Akademie der Wissenschaften, Vienna. Space Research Inst.
FIRST RESULTS OF BALLOON-BORNE X-RAY AND ELECTRIC FIELD OBSERVATIONS NEAR THE FOOTPRINT OF THE VIKING SATELLITE
W. Riedler, K. M. Torkar, and H. Slamanig *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 79-84 (For primary document see N88-16201 08-46)
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Balloon observations of auroras were conducted simultaneously with Swedish Viking satellite and EISCAT and STARE radar campaigns to study energy spectra and morphology of precipitating electrons in different substorm phases, the morphology of the X-ray precipitation zone, and the relationship between electric fields, field aligned currents, VLF waves, and precipitation zones. Telemetry, X-ray, and electric field instruments are described. Correlations between electric field and X-ray data, and between magnetic disturbances and electric fields are shown. ESA

N88-16216# Utah State Univ., Logan.
HOW GROUND-BASED OBSERVATIONS CONTRIBUTE TO ROCKET, BALLOON AND SPACE SHUTTLE EXPERIMENTS: EXPERIENCE FROM THE PAST AND OUTLOOK FOR THE FUTURE
K. D. Baker *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 87-98 (For primary document see N88-16201 08-46)
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The role of the ground station in space-based measurements to aid launch decisions (primarily with sounding rockets); place spot measurements in perspective of long-term morphology; give additional observational data on the phenomena under study; provide ground truth, intercomparisons and calibration; and develop and test space measurement techniques is reviewed. Radar; lidar; passive optical and radio observations; and magnetometers are

discussed. Rocket, balloon, and shuttle measurement campaigns and programs where the ground-based observations are a key part of the overall program are cited. ESA

N88-16217# University Coll., London (England). Dept. of Physics and Astronomy.
DEVELOPMENT OF A DOPPLER WIND LIDAR SYSTEM FOR ATMOSPHERIC WIND MEASUREMENTS **c47**
D. Rees, I. McWhirter, and D. Wade *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 99-106 (For primary document see N88-16201 08-46)
(Grants AF-AFOSR-0198-85; SGD-10115; PF-273)
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A stable, narrow band tunable lidar was built for measurement of mesopause and lower thermosphere temperatures using the resonance backscattering of sodium. The system demonstrates that the wavelength meter design and performance is adequate for Doppler wind measurement. The computer and dual port memory strategy was extended to allow the data acquisition of the Doppler detector to be performed using the same personal computer to operate wavelength meter and Doppler detector. The Doppler detector meets wind measurement requirements in continuous and pulsed modes. ESA

N88-16218# Bonn Univ. (West Germany). Inst. of Physics.
THE SODIUM LAYER AT 69 N LATITUDE IN WINTERTIME
U. vonZahn and C. Tilgner *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 107-112 (For primary document see N88-16201 08-46)
(Grant DFG-Ho-858/1-5)
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A ground-based lidar located near Andenes, Norway (69 N, 16 E geographic coordinates) measured over 500 Na density profiles during the period November 25, 1985 to March 14, 1986. Data were obtained on 19 nights. The nightly averages and winter averages of the derived Na column density, the maximum Na density, the altitude of the maximum Na density, and the halfwidth of the sodium layer are reported. Results are compared with those obtained in lidar studies of the Na layer at geographic latitudes of 51 N and 80 N. Results confirm the considerable variability of the sodium layer, with halfwidth showing the greatest variability. ESA

N88-16219# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France). Service d'Aeronomie.
LIDAR METAL DENSITY MEASUREMENTS IN THE UPPER ATMOSPHERE
J. P. Jegou and C. Granier *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 113-117 Sponsored in cooperation with CNES (For primary document see N88-16201 08-46)
(Grants CNRS-ATP-10/84; CNRS-ATP-29/83; CNRS-ATP-2/82)
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Lidar measurements of Ca, Ca(+), and Na from Dec 1986 to Nov 1986 in the south of France (44N, 6E) are discussed. The Na and Ca layers are compared, emphasizing seasonal changes and mean abundances. The very small mean total Ca abundance, 27 million/sq cm, a factor 100 inferior to the Na total abundance is noted. Simultaneous detection of Ca(+) allows the determination of two major parameters: the ratio of abundances (Ca)/(Ca(+)) related to ion chemistry, and the sum (Ca) + (Ca(+)) directly related to metal source and sink processes above 86 km. The very different values for these parameters measured on Na and Ca impose high constraints on metal modeling which are not easy to meet. ESA

N88-16220# University Coll., London (England). Dept. of Physics and Astronomy.
NEW TECHNIQUES FOR ROCKET AND BALLOON-BORNE INSTRUMENTATION FOR INVESTIGATIONS OF THE STRUCTURE, DYNAMICS AND ELECTRODYNAMICS OF THE MIDDLE ATMOSPHERE
D. Rees *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 121-130 Sponsored by the United Kingdom Science and Engineering Research Council (For primary document see N88-16201 08-46)
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Remote sensing of middle atmosphere structure (composition, temperature, density); remote sensing of middle atmosphere dynamics; and experimental, in-situ investigations of middle atmosphere electrodynamics are reviewed. Rocket campaigns are being planned to provide simultaneous observations of the interlinked parameters observable with these techniques. Using observational capabilities from the Space Station/Polar Platform, or other space-based facilities, it becomes possible to map many of these parameters over large regions of the atmosphere. ESA

N88-16221*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.
IMPROVED RESOLUTION ATMOSPHERIC DENSITY MEASUREMENTS BASED ON SIMULATIONS
F. J. Schmidlin, Hyo Sang Lee, and W. Michel (Dayton Univ., Wallops Island, Va.) *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 133-138 (For primary document see N88-16201 08-46)
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Simulated C band radar data of very structured atmospheric density profiles were analyzed using the standard HIROBIN program used with falling sphere data. Results show that HIROBIN can only resolve 2 km vertical waves up to 50 to 55 km, and 5 km waves up to 65 km. Above 65 km, only waves longer than 5 km can be resolved. Shorter filters can be used to improve vertical resolution, but it is concluded that HIROBIN can no longer be considered operational unless experienced personnel who fully understand the program are available for consultation. ESA

N88-16222# Physikalisch-Technische Studien G.m.b.H., Freiburg (West Germany).
DIAGNOSTIC CONCEPT OF THE RESONANCE CONE TECHNIQUE AND ITS APPLICATION IN GROUND AND SPACE EXPERIMENTS **c75**
H. Thiemann, A. Hoffmann, and A. Piel (Ruhr Univ., Bochum, West Germany) *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 139-142 (For primary document see N88-16201 08-46)
(Grant BMFT-01-TL-021-ZK/RT)
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The basic features of the resonance cone, i.e., the radiation pattern typical of a small RF antenna in a Maxwellian magnetoplasma, are theoretically described. Its experimental verification in ground tests for almost undisturbed Maxwellian plasmas is presented. The application of the resonance cone technique in space is discussed. Results of a rocket experiment in the equatorial ionosphere confirm the existence of the cone. ESA

N88-16223# Ruhr Univ., Bochum (West Germany). Inst. fuer Experimentalphysik 2.
RESONANCE CONES IN NONTHERMAL PLASMAS: LABORATORY EXPERIMENTS **c75**
A. Piel, G. Oelerich (Physikalisch-Technische Studien G.m.b.H., Freiburg, West Germany), and H. Thiemann *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 143-149 (For primary document see N88-16201 08-46)
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The resonance cone method is introduced. It is based on a high-frequency probe, which determines plasma parameters like electron density and temperature from the radiation pattern of a small antenna in a magnetized plasma. The method was extended to detect beam-like modifications of the electron distribution function. The experimental verification of an interference structure is reported and its capabilities as a diagnostic method for laboratory and ionospheric plasmas are discussed. Use of the method to study midlatitude ionospheric plasma from a sounding rocket is mentioned. ESA

N88-16224# Stockholm Observatory (Sweden).
A NEW LIQUID HELIUM-COOLED FABRY-PEROT SPECTROMETER USED IN A FAR INFRARED ASTRONOMICAL BALLOON EXPERIMENT c35
H. L. Nordh and S. G. Olofsson *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 151-155 (For primary document see N88-16201 08-46)
(Grants SWEDBSA-DR-21/85; SWEDBSA-DR-24/86)
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A liquid helium-cooled Fabry-Perot spectrometer for the far infrared spectral region is described. The Fabry-Perot filters consist of vacuum-spaced gold grids on crystal quartz substrates. Finesses between 30 and 60 and transmissions between 70% and 35%, respectively, were measured at 3 K. All nonactive crystal quartz surfaces are antireflection coated with 25 micron thick polyethylene. Using the scanning Fabry-Perot in the 28th order a spectral resolution of 800 is achieved at 160 microns. Scanning is mechanical without servocontrols to an accuracy corresponding to a finesse of 80. The detector used is a stressed, Ga-doped Ge-crystal having an intrinsic NEP of 10 to the minus 16th power WHz sup-1/2. ESA

N88-16225*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTRODYNAMICS OF THE HIGH LATITUDE MIDDLE ATMOSPHERE
R. A. Goldberg *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 159-168 (For primary document see N88-16201 08-46)
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Atmospheric electrodynamics is reviewed. The discovery of apparent large (V/m) electric fields within the mesosphere invites the possibility for this region to be electrically active. Observations of the V/m field were made at high latitudes even under active conditions, but always below heights where significant enhancements in electrical conductivity are found to occur. Two measurements at Andoya (Norway) show anticorrelation of horizontal field directions with wind directions, suggesting a mechanism which involves mechanical separation of charged aerosols. Reported evidence for such aerosols makes this concept more viable. Noctilucent clouds and mesospheric turbulence, and their influence on the local electrical environment are mentioned. ESA

N88-16226# Utah State Univ., Bedford, Mass.
COMPARISON OF SIMULTANEOUS MST RADAR AND ELECTRON DENSITY PROBE MEASUREMENTS IN THE POLAR MESOSPHERE
J. Ulwick, K. Baker, and M. Kelley (Cornell Univ., Ithaca, N.Y.) *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 169-174 (For primary document see N88-16201 08-46)
(Grant AF-AFOSR-0163-85)
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Two rockets containing dc Langmuir probes were launched in Alaska to measure electron density irregularities with high spatial resolution at times when radar showed regions of intense backscatter in the mesosphere. Large changes and strong gradients in the electron density are observed in the region of most intense backscatter. The electron density profiles show different characteristics in the peak scattering region. Spectra of the spatial density fluctuations are derived. In the region of most intense backscatter, the power is up over the whole frequency range by five orders of magnitude. An intercomparison of the probe data, and a comparison between the measured radar echo power and calculated echo power based on the in situ rocket measurements are given. ESA

N88-16227# Cologne Univ. (West Germany). Inst. for Geophysics and Meteorology.
DYNAMIC MODELING OF THE MIDDLE ATMOSPHERE
A. Ebel *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 175-179 (For primary document see N88-16201 08-46)
(Grants DFG-Eb-56/6; DFG-Eb-56/9)
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Wave perturbations in the mesosphere and lower thermosphere are considered. Employing a mechanistic model, the role of gravity waves, tides, and planetary waves for the general circulation is investigated. Numerical simulation experiments related to these types of wave perturbations are discussed: generation of planetary waves by gravity waves; response of the middle atmosphere to weak external forcing; and three dimensional simulation of tides. ESA

N88-16228# Freie Univ., Berlin (West Germany). Inst. of Meteorology.
LARGE-SCALE DYNAMICS OF THE MEAN FLOW BREAKDOWN IN THE STRATOSPHERE AND MESOSPHERE DURING THE WINTER 1983/84
K. Petzoldt *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 181-185 (For primary document see N88-16201 08-46)
(Grant DFG-La-372/13-4)
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The MAP/WINE data set calculated from all available observations for the winter 1983/84 was used to investigate the dynamics of the wind reversal in the stratosphere and mesosphere during a stratospheric major warming. Planetary wave amplitudes are computed and interpreted with regards to mean zonal wind changes. It is tested whether the reversal of the meridional gradient of the potential vorticity together with a critical level is a sufficient condition for the breakdown as suggested by theory for the nonlinear reflection of the waves into the polar cap. Results are unclear. ESA

N88-16229# Norwegian Defence Research Establishment, Kjeller.
OBSERVATIONAL EVIDENCE FOR SATURATION OF GRAVITY WAVES AND THE PRODUCTION OF TURBULENCE IN THE MESOSPHERE
E. V. Thrane, T. A. Blix, and C. Hall (Tromsoe Univ., Norway) *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 187-189 (For primary document see N88-16201 08-46)
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The MAP/WINE campaign information on small scale structure and turbulence in the winter mesosphere and lower thermosphere was assimilated to present a coherent picture of the small-scale dynamics of the atmosphere between 60 and 100 km. The results indicate that gravity wave saturation is a plausible mechanism for the creation of turbulence. ESA

N88-16230*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.
PROJECT CONDOR: MIDDLE ATMOSPHERE WIND STRUCTURE OBTAINED WITH LIGHTWEIGHT INFLATABLE SPHERES NEAR THE EQUATORIAL ELECTROJET
F. J. Schmidlin *In* ESA, Proceedings of the 8th ESA Symposium

on European Rocket and Balloon Programs and Related Research Aug. 1987 p 191-196 (For primary document see N88-16201 08-46)
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Observed correlations between the atmospheric electric field and the neutral wind were studied using additional atmospheric measurements during Project CONDOR. Project CONDOR obtained measurements near the equatorial electrojet (12 S) during March 1983. Neutral atmosphere wind measurements were obtained using lightweight inflatable spheres and temperatures were obtained using a datasonde. The lightweight sphere technology, the wind structure, and temperature structure are described. Results show that the lightweight sphere gives higher vertical resolution of winds below 75 km compared with the standard sphere, but gives little or no improvement above 80 km, and no usable temperature and density data. ESA

N88-16231# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France). Service d'Aeronomie.
AN ADVANCED VISIBLE-UV SPECTROMETER FOR ATMOSPHERIC COMPOSITION MEASUREMENTS c35
J. P. Pommereau and F. Goutail *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 197-200 (For primary document see N88-16201 08-46)
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A UV visible spectrometer using a multielement detector was developed for solar occultation observations from balloons. The instrument was flown twice with classical photomultiplier spectrometers on the same gondola during satellite Sage 2 passages above the area. Comparisons between all the observations show an improvement of the resulting precision on retrieved NO2 concentration with the instrument by a factor 10. Based on this development, a lightweight automatic apparatus for long duration balloon and frequent tropospheric soundings was designed. ESA

N88-16232# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France). Service d'Aeronomie.
IN-SITU STRATOSPHERIC WATER VAPOR MEASUREMENTS ON BOARD LONG DURATION BALLOONS
F. Goutail and J. P. Pommereau *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 201-205 (For primary document see N88-16201 08-46)
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Balloon experiments which are part of preparation of a worldwide study of tropospheric air injection into the stratosphere, the so-called stratospheric fountain, are reviewed. Flight results show that the water-vapor instruments developed are convenient for measuring mixing ratios as low as 1 ppmv expected in the equatorial region, provided the flight is long enough to allow a complete outgassing of the gondola, which requires 10 days. The flights also demonstrate that technical problems still exist in the balloon and data systems. ESA

N88-16233*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.
ROCOZ-A (IMPROVED ROCKET LAUNCHED OZONE SENSOR) FOR MIDDLE ATMOSPHERE OZONE MEASUREMENTS c35
H. S. Lee (SM Systems and Research Corp., Landover, Md.) and C. L. Parsons *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 207-214 (For primary document see N88-16201 08-46)
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An improved interference filter based ultraviolet photometer (ROCOZ-A) for measuring stratospheric ozone is discussed. The payload is launched aboard a Super-Loki to a typical apogee of 70 km. The instrument measures the solar ultraviolet irradiance as it descends on a parachute. The total cumulative ozone is then calculated based on the Beer-Lambert law. The cumulative ozone precision measured in this way is 2.0% to 2.5% over an altitude range of 20 and 55 km. Results of the intercomparison with the SBUV overpass data and ROCOZ-A data are alsc discussed. ESA

N88-16234# Bonn Univ. (West Germany). Inst. fuer Physik.
TOTAL: A NEW INSTRUMENT TO STUDY TURBULENT PARAMETERS IN THE MESOSPHERE AND LOWER THERMOSPHERE c35
F. J. Luebken *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 215-218 (For primary document see N88-16201 08-46)
(Grant BMFT-01-OE-86-046)
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A rocket-borne instrument used to deduce turbulent parameters (e.g., turbulent energy dissipation rates) from in-situ measurements of small scale density fluctuations is presented. The basic item is an ionization gage, which can measure in a pressure range from 0.0000005 to 1 mbar with a total time constant of the order of msec. ESA

N88-16235# Swedish Space Corp., Esrange.
ESRANGE (SWEDEN): NEW INSTALLATIONS, FUTURE PLANS AND INVESTMENTS c14
A. Helger *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 221-224 (For primary document see N88-16201 08-46)
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The Esrange sounding rocket launch site and satellite ground station in Sweden, above the Arctic Circle, is described. Space activities are carried out in international cooperation using ground based instrumentation, balloons, sounding rockets, and satellites. Due to the geographical location, scientific studies of the aurora and other high latitude phenomena are of particular interest. The land recovery possibility makes Esrange very suitable for microgravity and other space science experiments using sounding rockets. It is possible to make simultaneous measurements of scientific phenomena using ground based instrumentation, scientific balloons, sounding rockets, and satellites. Plans include launching of rockets to 1000 km and small satellites into polar orbits. ESA

N88-16236# Andoya Rocket Range, Andenes (Norway).
FACILITIES AND PLANS FOR IMPROVEMENTS AT ANDOYA (NORWAY) ROCKET RANGE c14
K. Adolfsen and I. Nyheim *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 225-227 (For primary document see N88-16201 08-46)
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The Andoya (Norway) rocket range data handling system, optical equipment, lidar observatory, telemetry stations, control center, launch facilities, impact area, launch restrictions, guidance, payload recovery, and satellite launching potential are discussed. ESA

N88-16237# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
THE DFVLR-GERMAN SPACE OPERATIONS CENTER (GSOC) MOBILE ROCKET BASE c14
K. Zdarsky, W. Gabriel, X. M. Kalteis, and P. Turner *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 229-234 (For primary document see N88-16201 08-46)
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A mobile base for sounding rocket and balloon launches is presented. All equipment is integrated into standard containers for easy transportation and setup. The main activities are: campaign organization and operations; rocket/balloon preparation and launch; vehicle tracking and trajectory determination; telemetry data receiving, recording, processing; and payload subsystems development and integration. The tracking radars, recovery systems, and telemetry equipment are described. ESA

N88-16238# Centre National d'Etudes Spatiales, Toulouse (France).
OPERATIONAL ACTIVITY AND IMPROVEMENTS IN THE SERVICES AND FACILITIES OF THE BALLOON LAUNCH CENTERS IN FRANCE **c14**
P. Faucon *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 235-238 (For primary document see N88-16201 08-46)
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Statistics on balloon flight (number, duration, payload, reliability) are presented. Developments in telemetry/telecommand, and balloons are described. Azimuth control for stratospheric gondolas is mentioned. ESA

N88-16239# Centre National d'Etudes Spatiales, Toulouse (France).
LARGE BALLOON DEVELOPMENT AND TRANS-MEDITERRANEAN FLIGHTS **c02**
A. Soubrier, G. P. Cecchini (Consiglio Nazionale delle Ricerche, Rome, Italy), and M. Vasquez *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 239-240 (For primary document see N88-16201 08-46)
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The Transmediterranean Balloon Flight Organization ODISSEA is described. It is a joint venture between France, Italy, and Spain, and gives an opportunity to perform long duration (greater than 27 hr) flights at a high level of performance. Nearly 40 flights were completed, and outstanding results were obtained thanks to the appearance of a polyethylene successfully used to build very large balloons (up to 1 million cu m) carrying very heavy payloads (2200 kg). The ODISSEA facilities, and the services offered to the scientific community are outlined. ESA

N88-16240*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.
INSTRUMENTATION UTILISATION FOR RISK CONTROL IN SAFETY OPERATIONS **c35**
F. R. Swayer *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 241-245 (For primary document see N88-16201 08-46)
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Ways in which instrumentation is utilized for risk control for inherently safe (no control or guidance) and flight programmed launch vehicles is presented. Instrumentation and how it is utilized in the launching and recovery of balloons and payloads is also presented. Wind sensing, computer systems, tracking, and telemetry are discussed. ESA

N88-16241# University Coll., London (England). Dept. of Physics and Astronomy.
A NEW TECHNIQUE FOR ROCKET AND SPACE-BORNE INVESTIGATIONS OF TIME-DEPENDANT AURORAL MORPHOLOGY
D. Rees and A. Steen (Kiruna Geophysical Inst., Sweden) *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 249-253 Sponsored in part by the United Kingdom Science and Engineering Research Council (For primary document see N88-16201 08-46)
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A spin-scan auroral imager of extremely high sensitivity is described. The instrument is based on an imaging photon detector, with 20 discrete colinear anodes or photometer channels, each with a field of view 3 deg high and 10 deg wide, oriented parallel to the rocket spin axis. During each spin of the rocket, therefore, the imager sweeps out a 65 deg wide swath in elevation, centered on the equator of the rocket payload. This combination of azimuthal and elevation scan data obtained during each spin, and the vertical and lateral motion of the rocket during its flight, allows a full tomographic inversion of auroral and airglow structures. The data obtained from a rocket flight indicates that a similar instrument, flown in a polar orbit, could image using emissions of 10 R and integration times of 5 sec, considerably enhancing present capabilities. ESA

N88-16242# Oslo Univ. (Norway). Dept. of Physics.
POLAR CUSP ELECTRODYNAMICS
P. E. Sandholt and A. Egeland *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 255-260 (For primary document see N88-16201 08-46)
(Grant NATO-RG-85/0521)
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By combining continuous ground-based observations of polar cusp auroras with electromagnetic parameters obtained from satellites in polar orbit and in the magnetosheath, electrodynamic processes in the polar cusp were investigated. The observed shifts in latitude of the cusp and the relationship with the interplanetary magnetic field orientation and magnetospheric substorms were studied. Satellite measurements of magnetic field and ion drift components above auroral structures observed from the ground permit detailed investigations of auroral electrodynamics in the cusp ionosphere. Results include the recording of equatorward movements of cusp simultaneous with evening-midnight sector auroras during a period of stable, negative magnetosheath magnetic field 2 component, well before substorm expansion phase onset. ESA

N88-16243# Norwegian Defence Research Establishment, Kjeller.
MAIMIK: A HIGH CURRENT ELECTRON BEAM EXPERIMENT ON A SOUNDING ROCKET FROM ANDOYA ROCKET RANGE (NORWAY)
B. N. Maehlum, W. F. Denig, A. A. Egeland, M. Friedrich, T. Hansen, G. K. Holmgren, K. Maaseide, N. C. Maynard (Air Force Geophysics Lab., Hanscom AFB, Mass.), B. T. Narheim, and K. Svenes et al. *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 261-265 (For primary document see N88-16201 08-46)
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Two payloads (mother-daughter) connected by a tether were launched by sounding rocket to study the interactions between the electron beam and the environment for various boundary conditions and to study the physical processes associated with the neutralization of electrically charged vehicles in an ionospheric plasma. The daughter payload carried an accelerator which emitted pulses of electrons of 8 keV energies. The rocket instruments and results related to vehicle charging and neutralization are summarized. Results indicate extremely high charging of the daughter (several kV) for beam current greater than or = 80 mA. The reason may be the low plasma density (10 billion/cu m) in the F region during the experiment. ESA

N88-16244# Indian Inst. of Tropical Meteorology, Poona.
EFFECT OF NEUTRAL WIND ON THE LATITUDINAL VARIATION OF NIGHTTIME F-LAYER VERTICAL MOVEMENTS
P. E. Raj and P. C. S. Devara *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 267-269 (For primary document see N88-16201 08-46)
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Hourly ionospheric data of low/middle latitude stations in India and the meridional neutral wind data of Kuhlungsborn and Obninsk (54 deg 01 N, 55 N respectively) were taken to investigate the effect of winds on the latitudinal variation of nighttime F-layer vertical movements. Results show that the electrodynamic drifts control the nighttime F-layer vertical movements at near-equatorial latitudes. The latitudinal variation noticed in the vertical movements at low and high-midlatitude stations could be due to the latitudinal variation in the magnitude and the time of occurrence of direction reversal of meridional neutral winds. The observed diurnal and

seasonal behavior of F-layer vertical movements supports this.
ESA

N88-16245# Science Research Council, Chilton (England). Rutherford Appleton Lab.
WAVE ACCELERATION OF AURORAL ELECTRONS
D. A. Bryant *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 273-279 (For primary document see N88-16201 08-46)
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Process in developing a quantitative model of electron acceleration by lower-hybrid waves, arising as an instability in magnetospheric ion streams, is reported. Endorsements from simulation studies are presented, and applications in other areas of space plasma physics are identified. ESA

N88-16246# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
ACCELERATION OF AURORAL PARTICLES BY MAGNETIC FIELD-ALIGNED ELECTRIC FIELDS
L. P. Block *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 281-287 (For primary document see N88-16201 08-46)
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Measurements on the S3-3 and Swedish Viking satellites show that a large fraction of magnetic field-aligned potential drops are made up of multiple double layers. Solitons and double layers in U-shaped potential structures produce spiky electric fields also perpendicular to the magnetic field in agreement with satellite measurements. The large scale potential structures associated with inverted V-events are built up of many similar short-lived structures on a small scale. Viking measurements indicate that electric fields parallel to the magnetic field are almost always directed upward.
ESA

N88-16247# Centre de Recherches en Physique de l'Environnement, Saint Maur des Fosses (France).
INTERPLANETARY MAGNETIC FIELD (IMF) INFLUENCE ON THE MAGNETIC CONFIGURATION AND PARTICLE FLUXES AT GEOSTATIONARY ORBIT AND ON THE SUBSTORM ONSET
K. Bruening and P. Tanskanen (Oulu Univ., Finland) *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 289-291 (For primary document see N88-16201 08-46)
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Substorm onset and the westward traveling surge (WTS) were studied for March 31, 1979 near local midnight (CDAW 6 event) comparing IMP 8, GEOS 2, and ground based observations. During a period of southward IMF-Bz the geomagnetic field at GEOS 2 became tail-like and the energetic electron and ion fluxes decreased. A short northward excursion of the IMF triggered the onset. The geomagnetic field became dipole-like and the energetic electron and ion fluxes increased. At that time a WTS and a negative bay in the magnetic field were observed on the ground. This substorm onset was apparently generated near the Earth (near GEOS 2) where an unstable boundary between the two magnetic configurations with a hot particle distribution of the ring current (dipole-like configuration) and the distribution with lower energies further tailward (tail-like configuration) were observed. It is suggested that this boundary was generated by variations in the IMF. ESA

N88-16248# University Coll., London (England). Dept. of Physics and Astronomy.
DEVELOPMENTS IN INSTRUMENTAL TECHNIQUES FOR OBSERVATIONS OF MAGNETOSPHERIC AND IONOSPHERIC SHAPED CHARGE RELEASES
D. Rees and N. P. Meredith *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 293-297 (For primary document see N88-16201 08-46)
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Rocket experiments releasing high altitude barium and strontium shaped charges were observed by ground-based imaging and Doppler imaging systems. Experiments investigated the perpendicular and field-aligned flows and accelerations of ions under auroral oval and polar cap conditions. Ion jets created by the releases were tracked to altitudes between 20,000 and 50,000 km above active auroras. Other releases used the shaped charge technique to test the critical velocity mechanism (Alfven). Results obtained by the imaging systems and the Doppler imaging systems, mapping the line-sight velocity distribution over the surface of the ion jets, are presented. ESA

N88-16249# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
CAESAR INVESTIGATIONS
K. Rinnert, K. Wilhelm, H. Kohl, K. Schlegel, G. Dehmel, H. Luehr, N. Kloecker, W. Oelschlaegel, M. P. Gough, and B. Holback (Uppsala Ionospheric Observatory, Sweden) et al. *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 299-303 Sponsored in part by BMFT (For primary document see N88-16201 08-46)
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The Coordinate Auroral Experiment using Scatter And Rocket investigations was performed by combining high resolution in-situ measurements using rocket-borne instrumentation and ground-based observations with EISCAT. Magnetosphere/ionosphere interaction during discrete auroral arc conditions was studied by observing energetic charged particle distributions and electrodynamic processes as well as parameters of the ionospheric plasma associated with the arc. The electric and magnetic field configurations and the current systems related to the arc were investigated. Two identical payloads were built and launched with Skylark 12 motors from Andoya (Norway). ESA

N88-16250# Technische Univ., Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
OBSERVATIONS OF FIELD-ALIGNED CURRENT STRUCTURES DURING THE COORDINATED AURORAL EXPERIMENT USING SCATTER AND RADAR (CAESAR) FLIGHT 2
H. Luehr, W. Oelschlaegel, K. Rinnert, and K. Wilhelm (Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany) *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 305-309 (For primary document see N88-16201 08-46)
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Magnetic field measurements from a sounding rocket are described. High resolution magnetic field vector measurements were obtained. A precision star sensor was employed. The magnetic effects of the polar electrojet as well as of field-aligned currents were measured. Close to apogee, small-scale field-aligned current structures identified by combination of E and B-field measurements as active acceleration regions, are observed.
ESA

N88-16251# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
EISCAT MEASUREMENTS OF ION VELOCITIES DURING COORDINATED AURORAL EXPERIMENT USING SCATTER AND ROCKETS (CAESAR) CAMPAIGN
H. Kohl and K. Rinnert *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 311-313 (For primary document see N88-16201 08-46)
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The EISCAT radar measured ion velocities underneath a rocket trajectory scanning over seven locations along an auroral arc. From the ion velocities electric fields were derived and compared with in-situ measurements on board the rocket. South of the arc

region there is good agreement between both measurements. Inside the arc region, however, there are large discrepancies. It is concluded that localized field aligned currents play an important part, together with the fact that the rocket trajectory deviated from the EISCAT points of observation. ESA

N88-16252# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
REMOTE AND IN-SITU PLASMA MEASUREMENTS DURING THE COORDINATED AURORAL EXPERIMENT USING SCATTER AND ROCKETS (CAESAR) FLIGHT c75
K. Schlegel and K. I. Oyama *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 315-318 (For primary document see N88-16201 08-46)
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Plasma quantities like electron temperature and density as well as ion temperature were measured in-situ and from the ground. With incoherent scatter measurements the general geophysical conditions prevailing during the flight were explored. Enhanced electron densities as well as Joule heating indicate the presence of an auroral arc. The electron temperature data obtained with the rocket-borne retarding potential analyzer show a lot of structure and agree well with the results of an RF Langmuir probe. The electron temperatures increases strongly above the arc and shows anisotropy with respect to the magnetic field direction. Estimates of the flux of suprathermal electrons are discussed. ESA

N88-16253# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
LOW FREQUENCY ELECTROSTATIC WAVES OBSERVED ON BOARD THE COORDINATED AURORAL EXPERIMENT USING SCATTER AND ROCKETS (CAESAR) 2 PAYLOAD
K. Rinnert *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 319-321 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

Direct current electric field measurements to 150 Hz were performed on board a rocket payload. South of a faint localized auroral arc impulsive electrostatic signals with fundamental frequencies below the ion cyclotron frequency are observed. These wave fields have characteristics of ion beam driven electrostatic ion cyclotron wave models described by Yamada et al., (1977). Such waves are confined to the interior of supersonic ion beams, and the observations indicate the occurrence of upward directed, localized, and extremely narrow ion beams with beam velocity 5 times the ion thermal velocity and beam width of typically 30 m. ESA

N88-16254# Stockholm Observatory (Sweden).
JUSTIFICATION AND PROSPECTS OF OBSERVATIONS OF INTERSTELLAR, FAR-INFRARED EMISSION LINES, USING A SMALL-SIZED BALLOON-BORNE TELESCOPE c89
H. L. Nordh and S. G. Olofsson *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 329-332 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

Far infrared observation of atomic and ionic emission lines, to study the physics and chemistry of the interstellar medium and star-forming regions is discussed. The potential of a small-sized balloon experiment, carrying a cryogenic spectrometer with a large field-of-view (greater than 10 arc min) is addressed. Examples of galactic and extragalactic objects which will be observed in the 157.7 microns (C(+)) emission line during balloon flights are given. ESA

N88-16255# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
PRONAOS: A SUBMILLIMETER FACILITY c74
G. Serra, G. Bellaiche, P. Encrenaz, and J. M. Lamarre (Centre National de la Recherche Scientifique, Verrieres-Le Buisson, France) *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 333-336 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

A 2 m balloon-borne submillimeter telescope, intended to provide a facility for long duration flights (greater than 20 hr) for photometry and spectroscopy in the spectral range 80 microns to 1.5 mm is presented. Focal plane instruments are: a multiband photometer device using He3 cooled bolometers and He4 cooled filters; and a submillimeter heterodyne spectrometer. The 2 m Cassegrain telescope, with a lightweight primary mirror has an equivalent focal ratio F/10. The telescope is pointed (accuracy 5 arc-sec rms) with a two-stage stabilization having a two-axis system: the azimuth orientation of the gondola from the decoupling with the balloon (accuracy of a few arc-minutes); and an elevation/cross-elevation gimbal. ESA

N88-16256# Oslo Univ. (Norway). Inst. of Theoretical Physics.
THE EUV LINE FLUX VARIATIONS AND ACTIVITY IN ALPHA ORIONIS c89
O. Elgaroey, O. Engvold, and P. Joeras *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 337-340 (For primary document see N88-16201 08-46)
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Studies of the red, bright supergiant star Alpha Orionis, using the IUE over an eight-year period show significant variations in the EUV line fluxes of the star. Neither the long term cyclic variation in radial velocity and in visual brightness, nor the relative position of the orbiting inner stellar companion of the triplet stellar system, seem to be connected with observed fluctuations in EUV line fluxes. Short term fluctuations in optical brightness (B magnitude) believed to be associated with transient (active) regions in the atmosphere of the star, are well correlated with EUV line flux variations. ESA

N88-16257# Oslo Univ. (Norway). Inst. of Theoretical Astrophysics.
ULTRAVIOLET ROCKET-SPECTRA OF A SUNSPOT c92
P. Brekke, O. Kjeldseth-Moe, J.-D. F. Bartoe, and G. E. Brueckner (Hulburt, E. O. Center for Space Research, Washington, D.C) *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 341-345 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

Downflows in the transition zone above a sunspot were observed with a high resolution telescope and spectrograph on a rocket. The rocket spectra on photographic film were digitized. Noise caused by film grains was removed by Fourier filtering. The spectral images were corrected for geometrical distortions and calibrated to give the solar intensity as a function of wavelength. Maximum speeds of 200 km/sec are reached in the flows which extend over 60 arc-sec along the slit. Components with distinct, but lower velocities also appear. The variations with temperature of the characteristic flow speeds are studied. ESA

N88-16258# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France). Lab. de Physique Stellaire et Planetaire.
SOLAR ULTRAVIOLET SPECTRUM OBTAINED FROM A BALLOON GONDOLA c92
D. Samain and P. Lemaire *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 347-350 (For primary document see N88-16201 08-46)
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A 30 cm balloon-borne spectrographic telescope recorded high resolution solar spectra in the 2800 A channel (1 arcsec and 15 mA). Time sequences at Sun center, limb, intermediate location, and on a prominence were performed. Data reduction of the high spectral resolution spectra recorded was completed for the region

1950 to 2000 A. A detailed tracing is given and results on wavelength shifts are analyzed. ESA

N88-16259# Indian Inst. of Tropical Meteorology, Poona.
SOME GROUND-BASED OPTICAL OBSERVATIONS OF COMET HALLEY DURING ITS POST-PERIHELION PASSAGE **c90**
P. C. Devara and P. E. Raj *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 351-355 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

Ground-based observations in the visible and near-infrared of the spectrum of comet Halley were carried out during 12 March - 29 April 1986 using a photometer composed of a 250 mm Newtonian reflector, and light detection and data recording equipment. The photometer and the experimental procedure for studying the comet are described. Results of prominent emissions and associated aspects of the comet are presented. ESA

N88-16260# Swedish Space Corp., Solna.
PRELIMINARY MATERIAL SCIENCE EXPERIMENT ROCKET (MASER) 1 RESULTS AND THE EVOLUTION OF THE MASER PROGRAM **c29**
J. Zaar, L. Bjoern, and R. Joensson *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 359-361 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

The four experiment modules flown on a sounding rocket are described. These are: the SSC/gradient furnace module, containing four experiments; ESA multi-mission mirror furnace module with two high performance isothermal furnaces; ESA fluid science module containing three different fluid science experiments; and the Gravity Experiment on Detector Elements module with two furnaces for the processing of CdHgTe detector material. Continuation of the program is outlined. ESA

N88-16261# Saab-Space A.B., Linkoeping (Sweden).
FLIGHT RESULTS OF THE ESA EXPERIMENT MODULES IN MATERIALS SCIENCE EXPERIMENT ROCKET (MASER) 1 **c29**
H. Grunditz *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 363-367 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

The ESA multimission mirror furnace module (M4) and fluid science module (FSM) were launched by sounding rocket and achieved 7 min 15 sec microgravity flight. The M4 studied meniscus stability in immiscibles, with no problems, and coalescence in immiscible alloys, where although the furnace stopped just after melting phase (due to failure of a standard 5V regulator) interesting results are obtained. The FSM studied thermal conductivity in liquids (no problems); thermocapillary drop motion, where drop composition problems did not prevent encouraging results being obtained; and three-dimensional Marangoni convection (no problems). ESA

N88-16262# Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Biochemie.
LIFE SCIENCES EXPERIMENTS ON STRATOSPHERIC BALLOONS AND SOUNDING ROCKETS **c51**
C. Wiese, B. Bechler, F. K. Gmuender, G. Lorenzi, and A. Cogoli *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 371-376 Sponsored by the Swiss Federal Inst. of Technology Board (For primary document see N88-16201 08-46)
(Grant SNSF-3.382-0.82)
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The results of an experiment with human erythroleukemic cells K-562 exposed to cosmic radiation on a stratospheric balloon flight are presented. The advantages offered by sounding rockets to short-term biological investigations in microgravity are discussed. It is recommended that ESA and national agencies organize more opportunities for experiments in balloons and sounding rockets for investigators in life sciences, as a complement for studies performed in Spacelab, in free flyers, and in the Space Station. Results show that hemoglobin synthesis is reduced by microgravity and cosmic radiation. ESA

N88-16263# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
THE D-1 BIORACK RESULTS: A BASE FOR FURTHER SPACE BIOLOGICAL INVESTIGATIONS **c51**
D. A. M. Mesland *In its* Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 377-382 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

Scientific results obtained with the first flight of the ESA Biorack on Spacelab mission D1 are summarized. Effects of microgravity on bacteria, unicellular organisms, human lymphocytes, and insect development are found. It is proposed that microgravity causes very subtle deviations in cell architecture and transportation mechanisms, which by accumulation in active cells become manifest as a measurable change in cell properties. Experiments to test this hypothesis are outlined. Experiments concerning phenomena of the cell surface, including cell fusion, are proposed to be of particular importance for biological studies using sounding rockets. ESA

N88-16264# University Hospital, Copenhagen (Denmark). Inst. of Aerospace Medicine.
SCIENTIFIC OBJECTIVES AND FUNCTIONAL REQUIREMENTS OF LIFE SCIENCES IN THE SPACE STATION **c51**
F. Bonde-Petersen *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 383-385 (For primary document see N88-16201 08-46)
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The scientific objectives for research in the Space Station on human physiology and medicine; animal physiology; plant physiology; cellular physiology; radiation biology and exobiology; and bioprocessing are summarized. Requirements for crew intervention and microgravity level are indicated. A pressurized module layout is shown. ESA

N88-16265# Karolinska Inst., Stockholm (Sweden). Dept. of Baromedicine.
THE ESA ANTHRORACK PROJECT: INTEGRATED RESEARCH IN HUMAN PHYSIOLOGY **c52**
D. Linnarsson *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 387-389 (For primary document see N88-16201 08-46)
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The Spacelab Anthrorack experiments, hardware, and experiment management are described. Fluid balance, cardiovascular dynamics and blood, endocrine responses, pulmonary function, and metabolism are studied. Anthrorack provides general power, cooling, recording, and computing facilities as well as services such as centrifuges, ergometers, ultrasonic monitors, and amplifiers to be shared by a limited number of investigators. Experiment specific equipment can also be accommodated. ESA

N88-16266# Centre National d'Etudes Spatiales, Paris (France).
CONTRIBUTION OF STRATOSPHERIC BALLOON FLIGHTS IN SPACE BIOLOGY **c51**
K. Bost, R. Tixador, G. Richoilley, M. Delpoux, G. Perbel, A. Cogoli, and C. Nogues (Centre d'Enseignement et de Recherches de Medecine Aeronautique, Paris, France) *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 391-394 (For

primary document see N88-16201 08-46)
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Results of biological research performed aboard satellites and/or stratospheric balloon flights are reported. Findings on bacteria cultivated with various concentrations of antibiotics; the proliferation and cell metabolism of Paramecia; the genetic effects of space in plants; cell proliferation, glucose consumption, and hemoglobin production in human cells; gravireaction of lentil seedlings; and lesional effects of cosmic rays in rat brains are presented. The advantages and disadvantages of balloon flights in space biological research in order to discriminate the respective parts of cosmic rays and weightlessness are discussed. ESA

N88-16267*# National Aeronautics and Space Administration, Washington, D.C.
FUTURE PLANS FOR THE NASA SUBORBITAL PROGRAM
S. D. Shawhan and J. R. Holtz *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 397-400 (For primary document see N88-16201 08-46)
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The development of more reliable heavy-lift balloons and a fine pointed gondola; the development of the Black Brant-12 rocket for auroral research; and the development of a collaborative Orbiting Payload Using Scout program are outlined. Through 1989 NASA will conduct a comprehensive program of aircraft, balloon, and rocket campaigns in conjunction with Shuttle and satellite measurements on the Supernovae 1987a. ESA

N88-16268# Bergen Univ. (Norway).
AURIO: A PROPOSAL FOR FLYING AURORAL IMAGING OBSERVATORY ON THE POLAR PLATFORM IN THE SPACE STATION/COLUMBUS PROGRAM
J. Stadsnes, K. Aarsnes, C. D. Anger, J. Bjordal, A. Brekke, D. Bryant, K. Broenstad, J. Carter, C. Chaloner, and L. L. Cogger (Calgary Univ., Alberta) et al. *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 401-404 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

It is proposed to fly high resolution auroral imaging instruments and particle spectrometers on the Columbus Polar Platform (PPF). A set of UV and X-ray imagers with wide field of view (horizon to horizon) will map the large scale (semiglobal) features of the aurora at day and night with fairly high spatial and temporal resolution. A set of visible and X-ray imagers and imaging spectrographs in visible and UV range with narrow field (NF) of view will give images with very high spatial resolution (better than 1 km and a few km respectively for optical and X-ray imagers) and a time resolution of 1 sec. The NF-imagers will be mounted on a pointable instrument pedestal to be operated in different modes. Particle spectrometers will cover electrons and ions over a wide energy range, and with high time resolution (10 ms). It is also desireable to fly a magnetometer. The particle and field instruments should be integrated in a separate package mounted on a boom protruding at least 10 m from the PPF, to minimize the contamination from the PPF environment. ESA

N88-16269# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
THE ROCKET AND SCATTER EXPERIMENT ROSE: PRESENTATION OF THE SCIENTIFIC PAYLOAD
G. Rose *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 405-409 (For primary document see N88-16201 08-46)
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A rocket payload consisting of 10 experiments to study plasma instabilities in the auroral E region (with incoherent scatter radar) is listed. Rockets measure electric and magnetic fields, plasma density, neutral air density, electron temperature, and ion mass distribution. The EISCAT radars measure ion drifts, ion tenperature, and electron density height profile. Scandinavian Twin Auroral Radar Experiment measures scattering intensity, mean radial Doppler velocity, and the spectral distribution of the scattered signals. ESA

N88-16270# Wuppertal Univ. (West Germany).
THE CRYOGENIC INFRARED SPECTROMETER AND TELESCOPE FOR THE ATMOSPHERE (CRISTA) EXPERIMENT ON ASTRO-SPAS
K. U. Grossmann and D. Offermann *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 411-415 (For primary document see N88-16201 08-46)
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A Cryogenic Infrared Spectrometer and Telescope for the Atmosphere (CRISTA) to analyze dynamical processes in the middle atmosphere via measurements of the variability of various trace constituents will be flown on a free-flying platform carried into orbit by the Space Shuttle. The CRISTA consists of 3 independent infrared spectrometers and of 3 telescopes simultaneously scanning the atmosphere at the limb in 3 viewing directions, enabling a good horizontal resolution of 400 km x 650 km grid spacing. Vertical resolution is 1.5 km. The spectrometers and telescopes are cooled by supercritical helium. ESA

N88-16271*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ROCKET EXPERIMENTS AND PAYLOADS FOR SUPER CAMP
E. Kopp (Bern Univ., Switzerland) and R. A. Goldberg *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 417-425 (For primary document see N88-16201 08-46)
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The super Cold Arctic Mesopause Project (CAMP) follow-up project in the summer of 1990 is outlined. In situ measurements of appropriate height resolution are needed in the summer mesosphere at high latitudes to investigate structures and formation processes of polar mesospheric clouds. The rocket measurements from the high latitude site Thule AB in Greenland (76.6 N) are decisive for the understanding of the cold Arctic mesopause. Similar rocket measurements from the European ranges Andenes and Esrange (68 to 69 N) are needed to investigate the latitudinal variability of the parameters relevant for the formation, transport, and loss of mesospheric ice particles. An important aspect of Super CAMP is the study of the heterogeneous chemistry, the loss of electrons on aggregates, and the build-up of horizontal and vertical electric fields in the presence of charged ice particles. Instruments, measurements, and purpose are listed. ESA

N88-16272# Bristol Aerospace, Ltd., Winnipeg (Manitoba).
PAST, PRESENT AND FUTURE ROLE OF BLACK BRANT ROCKET SYSTEMS TO SUPPORT INTERNATIONAL SPACE SCIENCE PROGRAMS **c20**
B. R. Payne and H. G. Sevier *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 427-432 (For primary document see N88-16201 08-46)
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The development of the Black Brant rocket is outlined. The rocket can carry payloads from 45 to 273 kg. Using boosters, it can reach altitudes greater than 1000 km, and a 4 stage vehicle capable of carrying 140 kg to 1500 km is being produced. The upper stages of Black Brants 8, 9, 10, and 12 use 17 in. diameter motors, allowing common use of payload support equipment such as despin, separation, and recovery modules. Reliability is greater than 95%. ESA

N88-16273# Saab-Space A.B., Linkoeping (Sweden).
GUIDANCE OF HIGH-ALTITUDE SOUNDING ROCKETS USING THE S19 AND SPINNING ROCKET ALTITUDE CONTROL (SPINRAC) SYSTEMS **c20**
L. Hall *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 433-436 (For primary document see N88-16201

08-46)
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Motor combinations to achieve microgravity periods of 12 to 20 min using sounding rockets are discussed. Common to all are impact dispersion problems, especially when land impact is preferred for payload recovery reasons. The possibilities to launch such a sounding rocket from Esrange (Sweden) are assessed. The dispersion is kept within the range limits by using the flight proven S19 boost guidance system for the initial part of the trajectory. The result is low first stage dispersion and high launch wind tolerance. The SPINRAC system handles dispersion for the exoatmospheric part of the motor burn. The SPINRAC repoints the motor before ignition to maintain a short impact range. ESA

N88-16274# British Aerospace Dynamics Group, Bristol (England). Space and Communications Div.
SKYLARK SOUNDING ROCKET DEVELOPMENT-SKYLARK 8 c20
J. A. Ellis *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 437-440 (For primary document see N88-16201 08-46)
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In recognition of the increasing need by the material science community to have longer duration time in a microgravity environment, the possibilities of extending the capability of the Skylark sounding rocket were investigated. The key features of the design of Skylark 8, and its performance potential, particularly the ability to offer greater than 15 min microgravity are reviewed. Skylark 8 is a two-stage, 0.94 m dia rocket for a 0.43 m dia payload similar to that carried on the TEXUS Program, but with fewer experimental modules. Typically a 270 kg payload is projected to 1000 km altitude. ESA

N88-16275# Space Vector Corp., Northridge, Calif.
THE ILV: A NEW COMMERCIAL EXPENDABLE LAUNCH VEHICLE c15
M. D. Griffin and J. H. Jerger *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 441-448 (For primary document see N88-16201 08-46)
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The Industrial Launch Vehicle (ILV) is a four-stage vehicle designed to place 1400 kg in a 250 km circular polar orbit for less than $8,000,000 U.S. The vehicle is comprised of 19 essentially identical hybrid engine modules. A suborbital test flight is planned, followed by orbital flight. Design rationale and development progress of the ILV are discussed. ESA

N88-16276# Observatoire de Paris-Meudon (France). Forecasting Center.
PREDICTION OF THE NEXT SOLAR ACTIVITY CYCLE c92
P. Lantos and P. Simon *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 451-453 (For primary document see N88-16201 08-46)
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Predictions of the amplitude and dates of the beginning and maximum of the next solar cycle are summarized. Predicted next cycle is a medium activity cycle, similar to cycles 13 (1889-1901), 15 (1913-1923), 17 (1933-1944) and 20 (1964-1976). The maximum for a cycle beginning mid 86 is in 1990. ESA

N88-16277# Saab-Scania, Goteberg (Sweden).
SOUNDING ROCKETS/MICROGRAVITY PRODUCTS AND SERVICE c29
A. Persson *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 455-459 (For primary document see N88-16201 08-46)
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Sounding rocket payloads for microgravity experiments; microgravity modules; the S19 boost guidance system; and the Spinning Rocket Attitude Control system are presented. ESA

N88-16278# Geophysical Observatory, Sodankyla (Finland).
FUTURE DEVELOPMENTS OF AURORAL D-REGION RESEARCH USING THE EISCAT VHF INCOHERENT SCATTER RADAR
E. Turunen, C. Hall, and T. Turunen (EISCAT Scientific Association, Kiruna, Sweden) *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 461-464 (For primary document see N88-16201 08-46)
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Use of the EISCAT VHF radar at 224 MHz to measure backscattered power and hence raw electron density, incoherent scatter spectral width, and bulk line-of-sight ion drift, and to deduce electron density, negative ion to electron number density, ion mass, line of sight neutral wind, and precipitating electron energy flux distribution is summarized. The utility of the radar in studying mesospheric dynamics and chemistry is shown. Solar radiation effects are studied. ESA

N88-16279*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CRUSTAL DYNAMICS PROJECT DATA ANALYSIS, 1987. VOLUME 1: FIXED STATION VLBI GEODETIC RESULTS, 1979-1986
J. W. Ryan and C. Ma Sep. 1987 169 p
(NASA-TM-100682; Rept-87-B-0480; NAS 1.15:100682) Avail: NTIS HC A08/MF A01 CSCL 08G

The Goddard VLBI group reports the results of analyzing Mark III data sets from fixed observatories through the end of 1986 and available to the Crustal Dynamics Project. All full-day data from POLARIS/IRIS are included. The mobile VLBI sites at Platteville (Colorado), Penticton (British Columbia), and Yellowknife (Northwest Territories) are also included since these occupations bear on the study of plate stability. Two large solutions, GLB121 and GLB122, were used to obtain Earth rotation parameters and baseline evolutions, respectively. Radio source positions were estimated globally while nutation offsets were estimated from each data set. The results include 25 sites and 108 baselines. Author

N88-16280*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CRUSTAL DYNAMICS PROJECT DATA ANALYSIS, 1987. VOLUME 2: MOBILE VLBI GEODETIC RESULTS, 1982-1986
C. Ma and J. W. Ryan Nov. 1987 130 p
(NASA-TM-100689-Vol-2; Rept-88-B-0042; NAS 1.15:100689-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 08G

The Goddard VLBI group reports the results of analyzing 101 Mark III data sets acquired from mobile observing sites through the end of 1986 and available to the Crustal Dynamics Project. The fixed VLBI observations at Hat Creek, Ft. Davis, Mojave, and OVRO are included as they participate heavily in the mobile schedules. One large solution GLB171 was used to obtain baseline length and transverse evolutions. Radio source positions were estimated globally, while nutation offsets were estimated from each data set. The results include 28 mobile sites. Author

N88-16281*# National Academy of Sciences - National Research Council, Washington, D. C.
INTERNATIONAL ROLE OF US GEOSCIENCE Final Report
Jun. 1987 104 p Sponsored in part by NASA; National Geodetic Survey, Rockville, Md.
(Grant NA84-AA-D-00009)
(NASA-CR-182407; NAS 1.26:182407; PB88-113683) Avail: NTIS HC A06/MF A01 CSCL 08G

Geologic processes are global in scope and no country or continent has areas that encompass all the phonomena. Joint participation between U.S. and foreign scientists is indispensable for advancing basic scientific concepts and their application to economic and policy issues in the U.S. Up-to-date knowledge is

critical to assure an adequate flow of industrial minerals and to assure an adequate supply of strategic minerals. GRA

N88-16282# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PROCESSES IN THE QUIET AND DISTURBED EQUATORIAL-LOW LATITUDE IONOSPHERE: SUNDIAL CAMPAIGN, 1984
M. A. Abdu, B. M. Reddy, G. O. Walker, R. Hanbaba, J. H. A. Sobral, B. G. Fejer, R. F. Woodman, R. W. Schunk, and E. P. Szuszczewicz (Science Applications International Corp., Washington, D.C.) Apr. 1987 37 p
(INPE-4152-PRE/1057) Avail: NTIS HC A03/MF A01

A network of ionospheric diagnostic instruments was operated on a world wide basis during the October 5-13, 1984 SUNDIAL campaign. The network provided a unique opportunity for a truly multiple technique global analysis of the equatorial-low latitude ionospheric behavior during the campaign period. The SUNDIAL equatorial low-latitude data set included electric field and spread F data from Jicamarca radar, ionosonde data from 15 stations and magnetograms from 5 stations operating in the American, African, Asian, and Indian sectors. Also included are data from electronic polarimeters and scanning photometers operated at Brazilian low-latitude sites. The data analysis has focussed attention on the global scale steady state ionospheric behavior and its predictability by the global theoretical model of Sojka and Schunk (1985) and by the International Reference Ionosphere (IRI). The results are suggestive of the need to modify existing quiet time electric field and neutral wind models in varying degrees for different longitude sectors. The analysis also concerns global scale ionospheric transient behavior in response to exo-ionospheric variabilities under disturbed conditions, in an approach towards better understanding of the factors that effect short term prediction schemes. Among the important outcomes of this study is the possibility of using longitude chains of equatorial ionosondes (and magnetometers) for investigation of equatorial ionospheric response to magnetospheric electric field penetration events and disturbance dynamo effects. Author

N88-16283# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
VERTICAL ATMOSPHERIC SOUNDING [SONDAGEM VERTICAL DA ATMOSFERA]
Yoshihiro Yamazaki, Yukitaka Nakamura, Carlos Ho Shih Ning, Maria Roseli Cabral, and Keiko Tanaka Sep. 1987 24 p In PORTUGUESE; ENGLISH summary Presented at the 6th Plenaria da SELPER Conference, Gramado, 10-15 Aug. 1987
(INPE-4370-PRE/1195) Avail: NTIS HC A03/MF A01

An enormous volume of environmental data can be derived from the measurements of spectral radiance of the Earth's surface and atmosphere, made by the instruments on board the polar orbit NOAA series satellite. The Tiros-N Vertical Operational Sounder (TOVS) instruments provide data to deduce the temperature and humidity from the surface up to the stratopause. To retrieve meteorological parameters, from the spectral radiance measurements, a full Export Package (DNEXPORT), was installed in the Burroughs-B6800 (48 bits/word) computer. The implemented DNEXPORT package is an improved version, modified from the previous one, by the inclusion of the physical algorithms. The DNEXPORT package also produces total ozone concentration in Dobson units, from the radiation emission of carbon dioxide and ozone of the stratosphere. Preliminary results from the physical solution using sounding received from the NOAA-9 satellite, on April 18, 1986, at INPE's Meteorological Satellite Reception Station/Cachoeira Paulista are presented. As it is well-known, the current Brazilian radiosonde network fails to solve several important problems on the tropospheric scale of motion. Since the final objective is to make an intensive use of satellite sounding system data, some comparison between satellite and conventional in-situ soundings that were available in conjunction with the near overpass of NOAA-9 are also presented. Author

N88-16067# Joint Publications Research Service, Arlington, Va.
TRAJECTORY SYNTHESIS OF IONOGRAMS IN PRESENCE OF ARTIFICIAL IONOSPHERIC INHOMOGENEITIES Abstract Only
N. P. Danilkin, D. S. Lukin, and V. I. Stasevich *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 56 Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow, USSR), v. 27, no. 2, Mar. - Apr. 1987 p 217-221 Original language document was announced in IAA as A87-42006 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16074# Joint Publications Research Service, Arlington, Va.
LONGITUDINAL VARIATIONS OF EQUATORIAL IONOSPHERE DETERMINED FROM INTERCOSMOS-19 ARTIFICIAL EARTH SATELLITE DATA Abstract Only
N. A. Kochenova *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 63 Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow, USSR), v. 27, no. 1, Jan. - Feb. 1987 p 142-144 Original language document was announced in IAA as A87-34255 (For primary document see N88-16063 08-42)
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N88-16077# Joint Publications Research Service, Arlington, Va.
ELECTRODYNAMICS OF MIDNIGHT SECTOR OF AURORAL OVAL IN PERIOD OF SLIGHT DISTURBANCE Abstract Only
E. M. Dubinin, P. L. Izraylevich, A. K. Kuzmin, N. S. Niklayeva, I. M. Podgornyy, A. N. Zaytsev, and V. G. Petrov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 66 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 223-234 Original language document was announced in IAA as A87-41738 (For primary document see N88-16063 08-42)
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N88-16078# Joint Publications Research Service, Arlington, Va.
AREA OF REDUCED ELECTRON CONCENTRATION IN TERRESTRIAL PLASMASPHERE Abstract Only
V. P. Grigoreva and V. V. Pisareva *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 67 Transl. into ENGLISH from Kosmicheskiya Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 235-242 Original language document was announced in IAA as A87-41739 (For primary document see N88-16063 08-42)
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N88-16082# Joint Publications Research Service, Arlington, Va.
HOLES IN OI 130 nm EMISSION FIELDS OF UPPER ATMOSPHERE DURING DAY Abstract Only
V. I. Krasovskiy and A. I. Semenov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 71 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 323-324 (For primary document see N88-16063 08-42)
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N88-16106# Joint Publications Research Service, Arlington, Va.
METHOD OF DETERMINING ATMOSPHERIC MOISTURE CONTENT BY MEASUREMENT OF UPWARD RADIATION INTENSITY IN NEAR IR Abstract Only
Ye. V. Ovchinikova *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 126 Transl. into ENGLISH from Issledovaniye Zemli iz Kosmosa (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 44-50 Original language document was announced in IAA as A87-48182 (For primary document see N88-16063 08-42)
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N88-16124# Joint Publications Research Service, Arlington, Va.
EFFECTIVENESS OF OCEANOGRAPHIC METHOD IN EARTHQUAKE PREDICTION Abstract Only
G. G. Yakushko *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 11-12 Transl. into ENGLISH from Vulkanologiya i Seysmologiya (Moscow, USSR), no. 5, Sep. - Oct. 1985 p

101-104 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16127# Joint Publications Research Service, Arlington, Va.
ELECTROMAGNETIC INDUCTION IN SPHERICAL EARTH CONTAINING OCEANS AND CONTINENTS IN ELECTRICAL CONTACT WITH UNDERLYING SECTION: THEORY, METHOD, EXAMPLE
B. Sh. Zinger, A. V. Kuvshinov, and E. B. Faynberg *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 19 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Zemli (Moscow, USSR), no. 10, Oct. 1986 p 51-65 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16128# Joint Publications Research Service, Arlington, Va.
GEOMECHANICAL MODEL OF SEISMOFOCAL ZONE OF ACTIVE CONTINENTAL MARGIN Abstract Only
S. S. Demin and S. Ye. Zharinov *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 28 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 290, no. 6, Oct. 1986 p 1339-1342 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16129# Joint Publications Research Service, Arlington, Va.
COMPREHENSIVE METHOD FOR DEFINING SEISMOGENIC ZONES Abstract Only
T. O. Babayan *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 29-30 Transl. into ENGLISH from Izvestiya Akademii Nauk Armyanskoy SSR: Nauki o Zemle (Yerevan, USSR), no. 3, May - Jun. 1986 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16130# Joint Publications Research Service, Arlington, Va.
DETERMINING DEEP HEAT FLOW UNDER COMPLEX GEOTHERMAL CONDITIONS Abstract Only
A. R. Kurchikov and B. P. Stavitskiy *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 33 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Seriya Geologicheskaya (Moscow, USSR), no. 11, Nov. 1986 p 121-127 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16131# Joint Publications Research Service, Arlington, Va.
CORRELATION BETWEEN SEISMIC ACTIVITY AND VARIATIONS OF MICROSEISMIC OSCILLATIONS Abstract Only
Ya. S. Sharipov *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 39-40 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Zemli (Moscow, USSR), no. 10, Oct. 1986 p 99-106 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16132# Joint Publications Research Service, Arlington, Va.
DETERMINING TRAJECTORY OF GROUND MOVEMENT ACCOMPANYING SEISMIC PHENOMENA Abstract Only
V. M. Grayzer *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 40 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Zemli (Moscow, USSR), no. 10, Oct. 1986 p 14-19 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16134# Joint Publications Research Service, Arlington, Va.
GREATEST VOLCANIC ERUPTIONS IN WORLD DURING 17TH-18TH CENTURIES AND WEATHER ANOMALIES IN EURASIAN MIDDLE LATITUDES Abstract Only
S. I. Varushchenko *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 41-42 Transl. into ENGLISH from Vestnik Moskovskogo Universiteta: Seriya 5, Geografiya (Moscow, USSR), no. 6, Nov. - Dec. 1986 p 64-71 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16137# Joint Publications Research Service, Arlington, Va.
ALLOWANCE FOR INFLUENCE OF GRAVITY FIELD NONUNIFORMITY Abstract Only
A. P. Tsysar *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 48 Transl. into ENGLISH from Geodeziya i Kartografiya (Moscow, USSR), no. 10, Oct. 1986 p 5-8 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16138# Joint Publications Research Service, Arlington, Va.
STUDY OF ASTHENOSPHERE: PROJECT ELAS Abstract Only
L. L. Vanyan *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 49 Transl. into ENGLISH from Vestnik Akademii Nauk SSSR (Moscow, USSR), no. 9, Sep. 1986 p 54-61 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16140# Joint Publications Research Service, Arlington, Va.
MESOSCALE AEROSOL CLOUDS Abstract Only
B. D. Belan and G. O. Zadde *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 51 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 290, no. 6, Oct. 1986 p 1328-1331 Previously announced as X87-73576 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16165# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
INVESTIGATIONS OF THE INFLUENCE OF CHEMICAL REACTIONS OF THE VERTICAL FLOW OF GASEOUS AND PARTICULATE COMPOUNDS [UNTERSUCHUNGEN ZUM EINFLUSS CHEMISCHER REAKTIONEN AUF VERTIKALE FLUESSE GAS- UND PARTIKELFOERMIGER VERBINDUNGEN]
Ralph Dlugi *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 129-134 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16170# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
RADIATION ABSORPTION IN THE INFRARED SPECTRAL RANGE: A COMPARISON BETWEEN LABORATORY MEASUREMENTS AND THEORETICAL CALCULATION ILLUSTRATED BY A H2O 2.7 MICROMETER [STRAHLUNGSABSORPTION IM INFRAROTEN SPEKTRALBEREICH: VERGLEICH VON LABORMESSUNGEN UND THEORETISCHEN BERECHNUNGEN AM BEISPIEL H2O 2.7 MICROMETER]
Adalbert Leupolt *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 161-164 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16172# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
LONG RANGE RECONNAISSANCE OF TRACE GASES: A SPECIAL ASPECT OF EMISSION SPECTROSCOPY [FERNERKUNDUNG VON SPURENGASEN SPEZIELLE ASPEKTE DER EMISSIONSSPEKTROSKOPIE]
Hermann Oelhaf *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 172-180 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16176# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
AEROSOL SIZE DISTRIBUTION FROM MEASUREMENTS OF THE RADIANCE IN THE SOLAR AUREOLE [DIE AEROSOLGROESSENVERTEILUNG AUS MESSUNGEN DER STRAHLDICHTE IN DER SONNENAUREOLE]
Edith Thomalla *In its* Research Work at the Meteorological

Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 200-207 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16177# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
COMPUTERIZED EVALUATION OF INTERFEROGRAMS OF THE MICHELSON INTERFEROMETER FOR PASSIVE ATMOSPHERIC SOUNDING (MIPAS) LABORATORY MODEL (LM) [DIE COMPUTERAUSWERTUNG VON INTERFEROGRAMMEN DES MIPAS - LABORMODELLS (LM)]
Werner Voelker *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 208-213 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16178# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
THE ITERATIVE RADIANCE MODEL OF THE METEOROLOGICAL INSTITUTE OF THE UNIVERSITY OF MUNICH (WEST GERMANY) [DAS ITERATIVE STRAHLDICHTEMODELL AM MIM]
Matthias Wiegner *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 214-220 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16590# Science Research Council, Chilton (England). Rutherford Appleton Lab.
THE FORMATION OF BOUNDARY LAYERS BY THE ENTRY OF LOW-ENERGY ELECTRONS AND ENERGETIC IONS INTO THE EARTH'S MAGNETOSPHERE
C. P. Chaloner, D. R. Lepine, D. S. Hall, D. A. Bryant, W. Stuedemann, B. Wilken, G. Kremser, F. Soeraas, K. Broenstad, and J. F. Fennell (Aerospace Corp., Los Angeles, Calif.) et al. *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 51-56 (For primary document see N88-16582 08-88)
Copyright Avail: NTIS HC A11/MF A01

N88-16592*# California Univ., Berkeley. Space Sciences Lab.
MICROPHYSICS OF THE AURORAL ACCELERATION REGION OF OTHER REGIONS OF THE MAGNETOSPHERE
F. S. Mozer, C. A. Cattell, M. Temerin, and J. Wygant *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 65-72 (For primary document see N88-16582 08-88)
(Grant NAG5-375)
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N88-16593# Air Force Geophysics Lab., Hanscom AFB, Mass.
A UNIFIED MODEL FOR THE WTS AND THE GENERATION ON Pi 2 PULSATIONS
P. L. Rothwell, M. B. Silevitch, and L. P. Block (Royal Inst. of Tech., Stockholm, Sweden) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 73-78 (For primary document see N88-16582 08-88)
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N88-16594# Los Alamos National Lab., N. Mex. ESS-8.
A POSSIBLE ROLE FOR IONOSPHERIC IONS IN TRIGGERING A GEOMAGNETIC SUBSTORM ONSET
Theodore A. Fritz *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 79-82 (For primary document see N88-16582 08-88)
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N88-16595# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
FIELD-ALIGNED FLUXES OF ENERGETIC ELECTRONS RELATED TO THE ONSET OF MAGNETOSPHERIC SUBSTORMS
G. Kremser, A. Korth, S. L. Ullaland, A. Roux, S. Perraut, A. Pedersen, R. Schmidt, and P. Tanskanen *In* ESA, Proceedings of the 21st ESLAB Symposium on Small-Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetry Medium and Planetary Magnetospheres Aug. 1987 p 83-86 (For primary document see N88-16582 08-88)
(Contract BMFT-PT-RV-14B12/73-WRK-243-SF)
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N88-16601*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
EVIDENCE OF SMALL-SCALE RECONNECTION IN THE MAGNETOSPHERE
R. C. Elphic, C. T. Russell, and D. J. Southwood (Imperial Coll. of Science and Technology, London, England) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 125-130 Sponsored in part by the United Kingdom Science and Engineering Research Council (For primary document see N88-16582 08-88)
(Contract NAS5-28448; Grant NAG5-536)
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N88-16602# Imperial Coll. of Science and Technology, London (England). Blackett Lab.
AN UNUSUAL MAGNETOPAUSE ENCOUNTER BY AMPTE-UKS
M. A. Saunders, C. J. Farrugia, M. W. Dunlop, W. A. C. Mier-Jedrzejowicz, M. F. Smith, and D. J. Rodgers (Mullard Space Science Lab., Dorking, England) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 131-134 Sponsored by a United Kingdom Royal Society Fellowship (For primary document see N88-16582 08-88)
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N88-16605# Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Weltraumforschung.
INFLUENCE OF VISCOSITY ON THE STRUCTURE OF A MAGNETIC NEUTRAL LAYER
Fausto T. Gratton, Martin F. Heyn, Helfried K. Biernat, Richard P. Rijnbeek, and Graciela Gnavi *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 143-148 Sponsored by the United Kingdom Royal Society (For primary document see N88-16582 08-88)
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N88-16606# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
EXPERIMENTAL EVIDENCE OF MICRO-NONEQUILIBRIUM ON THE MAGNETOPAUSE AND FURTHER PREDICTIONS
Zhen-jia Wu *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 149-151 (For primary document see N88-16582 08-88)
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N88-16607# Mullard Space Science Lab., Dorking (England).
ION FLOWS IN MAGNETOSPHERIC FLUX TRANSFER EVENTS
M. F. Smith, D. J. Rodgers, and M. A. Saunders (Imperial Coll. of Science and Technology, London, England) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and

Planetary Magnetospheres Aug. 1987 p 153-158 (For primary document see N88-16582 08-88)
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47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N88-16284# National Oceanic and Atmospheric Administration, Washington, D. C.
MARINERS WEATHER LOG, VOLUME 31, NUMBER 3, SUMMER 1987 Quarterly Report
[1987] 61 p
(PB87-234894) Avail: SOD HC $3.50 as 703-029-00011-6; NTIS MF A01 CSCL 04B

This journal presents the Mariners Weather Log for summer quarter of 1987. Articles included are entitled: Watch out for Nelson Eddy; Navigational safety - a DMA tradition; Surface currents in the Straits of Florida; Marine observation program; and Tips to the radio officer. Author

N88-16285*# Sigma Data Services Corp., Rockville, Md.
A VECTORIZED POISSON SOLVER OVER A SPHERICAL SHELL AND ITS APPLICATION TO THE QUASI-GEOSTROPHIC OMEGA-EQUATION
Paul Mullenmeister Washington NASA Feb. 1988 27 p
(Contract NAS5-20784)
(NASA-CR-4116; Rept-87-B-1000; NAS 1.26:4116) Avail: NTIS HC A03/MF A01 CSCL 04B

The quasi-geostrophic omega-equation in flux form is developed as an example of a Poisson problem over a spherical shell. Solutions of this equation are obtained by applying a two-parameter Chebyshev solver in vector layout for CDC 200 series computers. The performance of this vectorized algorithm greatly exceeds the performance of its scalar analog. The algorithm generates solutions of the omega-equation which are compared with the omega fields calculated with the aid of the mass continuity equation. Author

N88-16286# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
VARIATIONS OF TROPICAL CIRCULATION AND ASSOCIATED RAINFALL ANOMALIES, DURING 2 YEARS OF CONTRAST Ph.D Thesis [VARIACOES DAS CIRCULACOES TROPICAIS E AS ANOMALIAS DE PRECIPITACAO ASSOCIADAS, EM DOIS ANOS DE CONTRASTE]
Mary Toshie Kayano Sep. 1987 171 p In PORTUGUESE; ENGLISH summary
(INPE-4359-TDL/300) Avail: NTIS HC A08/MF A01

During 1983 severe droughts were observed over large areas of tropical lands and above normal rainfall over equatorial central Pacific related to the 1982 to 1983 El Nino, while during 1984 the precipitation pattern almost reversed. The analysis of the vertical velocity, calculated using observed wind, for 1983 and 1984, showed that the intensities and locations of the ascending and descending branches of the Walker circulation were consistent with the anomalous precipitation distribution. The north-south ITCZ migration played an important role to modulate the tropical precipitation, during 1983 and 1984. The return from the El Nino atmospheric circulation features to a normal pattern seems to have started around May 1983. Seasonal changes, such as the establishment of the summer monsoon regime over the Indian Ocean and India, contributed to this return. Highly significant correlation is verified between the Southern Oscillation Index (SOI) and the atmospheric water vapor. These calculations showed negative correlations for the central Pacific stations and positive correlations for the Indonesian stations, suggesting that the water vapor variations over these regions are modulated by the Southern Oscillation. The water vapor fluctuations are synchronized to the changes of the low level divergence field, such that an increase (decrease) of the convergence causes an increase (decrease) of water vapor content. Author

N88-16287*# National Academy of Sciences - National Research Council, Washington, D. C. Commission on Physical Sciences Mathematics and Resources.
CURRENT ISSUES IN ATMOSPHERIC CHANGE Final Report
1987 45 p Presented at the Summary and Conclusions of a Workshop, Washington, D.C., 30-31 Oct. 1986 Sponsored in part by NASA, National Climate Program Office, Rockville, Md., and Dept. of Agriculture, Washington, D.C.
(Grant NA87-AA-D-CP041)
(NASA-CR-182406; NAS 1.26:182406; PB88-114335) Avail: NTIS HC A03/MF A01 CSCL 04B

In response to questions about the effects of long-term, global-scale changes in the atmosphere raised in congressional hearings, a group of leading experts held a two-day workshop to survey the state of current knowledge about atmospheric changes and their implications. The review focuses on the sources, concentrations, and changes of those gases most directly linked to human activities, i.e., carbon dioxide, ozone, and the chlorofluorocarbons; the direct physical effects of rising concentrations of trace gases. The review discusses the uncertainties associated with the knowledge of current trends and possible future changes, including ozone trends and the Antarctic ozone hole, and the impacts of rising concentrations of trace gases. GRA

N88-16288# National Weather Service, Silver Spring, Md.
HURRICANE CLIMATOLOGY FOR THE ATLANTIC AND GULF COASTS OF THE UNITED STATES
F. P. Ho, J. C. Su, K. L. Hanevich, R. J. Smith, and F. P. Richards Apr. 1987 212 p Sponsored by Federal Emergency Management Agency, Washington, D.C.
(PB88-114657; NOAA-TR-NWS-38) Avail: NTIS HC A10/MF A01 CSCL 04B

A climatology of hurricane factors important to storm surge modeling is presented for the Atlantic and Gulf coasts of the United States. A smoothed frequency of hurricanes and tropical storms entering, exiting, and passing within 150 miles of the coast during the period 1871 to 1984 is given. The central pressure and radius of maximum winds for hurricanes occurring during the 85-year period, 1900 to 1984, were obtained from analysis of available hurricane data. Direction and speed of storm motion for hurricanes and tropical storms at the time they crossed the coast were also analyzed for the same 85-year period. The cumulative probability curves of each factor were plotted and analyzed for each 50-mile interval along the coast. GRA

N88-16289# Coastal Engineering Research Center, Vicksburg, Miss.
ANNUAL DATA SUMMARY AND CLIMATOLOGICAL EVALUATION CERC (COASTAL ENGINEERING RESEARCH CENTER) FIELD RESEARCH FACILITY, 1985. VOLUME 1. MAIN TEXT AND APPENDIXES A AND B Final Report
Herman C. Miller, Adele Militello, Michael W. Leffler, William E. Grogg, and Michael M. Dominguez Sep. 1987 93 p
(AD-A186442; CERC-TR-87-13-Vol-1-App-A/B) Avail: NTIS HC A05/MF A01 CSCL 08C

This report provides basic data and summaries for the measurements made during 1985 at the US Army Engineer Waterways Experiment Station (WES) Coastal Engineering Research Center's (CERC's) Field Research Facility(FRF) in Duck, N.C. The report includes comparisons of the present year's data to those of previous years and cumulative statistics from 1980 to the present. Summarized in this report are meteorological and oceanographic data, monthly bathymetric survey results, samples of quarterly aerial photography, and descriptions and hourly data for 13 storms that occurred during the year. The year was highlighted by the close passage of tropical storms Ana in July and Henri in September and Hurricanes Claudette in August and Gloria in September. Waves over 6m were measured, at a location 6km from shore, during Hurricane Gloria. This report is seventh in a series of annual summaries of data collected at the FRF. GRA

N88-16290# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
DEVELOPMENT AND TESTING OF AN INTERACTIVE PROCEDURE FOR THE IMPROVEMENT OF OBJECTIVE ANALYSES M.S. Thesis
Thomas M. Hamil Aug. 1987 87 p
(AD-A186595; AFIT/CI/NR-87-115T) Avail: NTIS HC A05/MF A01 CSCL 04B

A software package is developed for the Penn State/National Center for Atmospheric Research Mesoscale Model to allow interactive bogusing. This package permits the production of more realistic objective analyses. Previously, the process of inserting synthetic data in order to improve the objective analysis was done manually, which was inefficient and time-consuming. The new procedure uses newly developed bogusing software to make the process more efficient. The software has three parts: a data creation (bogusing) component, an objective analysis component, and graphics routines for displaying objective analysis output. To use this software, the user transfers an objective analysis from NCAR, where it is generated on the CRAY computer, to the user's local site. Next, these data are loaded into a supermicrocomputer. Using the graphics software, the user checks to see if bogus data are needed. If so, the bogusing software is used to efficiently create the synthetic data, and the objective analysis software is run to analyze the influence of these data. The user reexamines the analyses with the interactive graphics software and can repeat the cycle as needed until the desired initial conditions are created. These newly created bogus data are then sent back to the CRAY for use as numerical model initial conditions. GRA

N88-16291# Naval Postgraduate School, Monterey, Calif.
A STUDY OF FINITE DIFFERENCE AND FINITE ELEMENT VERTICAL DISCRETIZATION SCHEMES FOR BAROCLINIC PREDICTION EQUATIONS M.S. Thesis
Bruce G. Shapiro Jun. 1987 89 p
(AD-A186617) Avail: NTIS HC A05/MF A01 CSCL 04B

The vertical discretization in a linearized baroclinic prediction model was analyzed by comparing various finite element and finite difference solutions following Jordan (1985). Modifications were made on Jordan's (1985) Galerkin finite element approximation for two staggered grids. Comparisons were made with the unmodified models (Jordan, 1985) and with finite difference approximations for the same two staggered grids. The models were run with four experiments. Most of the oscillations that occurred in the temperature profiles near the surface of the unmodified Galerkin finite element approximations disappeared following the modifications. GRA

N88-15973# Manchester Univ. (England). Dept. of Mechanical Engineering.
AN INTRODUCTION TO SINGLE POINT CLOSURE METHODOLOGY
B. E. Launder *In* Von Karman Inst. for Fluid Dynamics, Introduction to the Modeling of Turbulence May 1987 90 p (For primary document see N88-15972 08-34)
Avail: NTIS HC A18/MF A01

N88-15974# Karlsruhe Univ. (West Germany). Inst. fuer Hydromechanik.
TURBULENCE MODELS FOR PRACTICAL APPLICATIONS
W. Rodi *In* Von Karman Inst. for Fluid Dynamics, Introduction to the Modeling of Turbulence May 1987 27 p Sponsored by Deutsches Forschungsgemeinschaft (For primary document see N88-15972 08-34)
Avail: NTIS HC A18/MF A01

N88-15975# Karlsruhe Univ. (West Germany). Inst. fuer Hydromechanik.
EXAMPLES OF TURBULENCE-MODEL APPLICATIONS
W. Rodi *In* Von Karman Inst. for Fluid Dynamics, Introduction to the Modeling of Turbulence May 1987 47 p Sponsored by Deutsches Forschungsgemeinschaft (For primary document see N88-15972 08-34)
Avail: NTIS HC A18/MF A01

N88-16107# Joint Publications Research Service, Arlington, Va.
LIMITING ACCURACY OF SCATTEROMETER DETERMINATION OF WIND SPEED OVER OCEAN FROM SATELLITE Abstract Only
G. N. Khristoforov, A. S. Zapevalov, and V. Ye. Smolov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 127 Transl. into ENGLISH from Issledovaniye Zemli iz Kosma (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 57-65 Original language document was announced in IAA as A87-48184 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16142# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
CROSS FLOW IN THE ALPS AND FLAT FOEHN DURING THE EXPERIMENT MERKUR [UEBERSTROEMUNG DER ALPEN UND FLACHER FOEHN WAEHREND MERKUR]
Michael Ahr *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic oof Germany) Mar. 1987 p 3-9 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16144# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
THE ROLE OF ANABATIC WINDS IN THE HEATING OF VALLEYS [DIE ROLLE DER HANGWINDE BEI DER ERWAERMUNG VON TAELERN]
Matthias Brehm *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 18-23 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16146# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
RESULTS OF THE EXPERIMENT MERKUR: STRUCTURAL CHANGE OF A WEAK COLD FRONT IN THE SPHERE OF INFLUENCE OF THE ALPS [ERGEBNISSE DES EXPERIMENTS MERKUR: STRUKTURAENDERUNG EINER SCHWACHEN KALTFRONT IM EINFLUSSBEREICH DER ALPEN]
Carl Freytag *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 30-36 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16149# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie
TURBULENCE STRUCTURE DURING HIGH WIND [TURBULENZSTRUKTUR BEI STARKWIND]
Heinz Loesslein *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 50-54 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16150# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
EXTRAPOLATION OF EXTREMUM VALUES OF THE WIND VELOCITY [EXTRAPOLATION VON EXTREMWERTEN DER WINDGESCHWINDIGKEIT]
Hans Schroers *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 55-61 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16152# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
VERTICAL SOUNDING OF TH AIR LAYER CLOSE TO A GLACIER ON MOUNT VERNAGFERNER IN THE OETZAL ALPS, TYROL (EXPERIMENT LUZIVER 1983) [VERTIKALSONDIERUNGEN DER EISNAHEN LUFTSCHICHT AM VERNAGTFERNER (LUZIVER 1983)]
Markus Weber *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 68-72 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16154# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
SIMULATION OF A TYPICAL FLOW IN A BROAD VALLEY [SIMULATION EINER TYPISCHEN STROEMUNG IN EINEM BREITEN TAL]
Jutta Graf *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 77-79 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16155# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
MODEL CALCULATIONS OF THE BEHAVIOR OF OROGRAPHICALLY INFLUENCED COLD FRONTS [MODELLRECHNUNGEN ZUM VERHALTEN OROGRAPHISCH BEEINFLUSSTER KALTFRONTEN]
Klaus Haderlein *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 80-83 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16156# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
DENSITY FLOWS AT THE MOUNTAIN EDGE [DICHTESTROEMUNGEN AM GEBIRGSRAND]
G. Hartjenstein *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 84-88 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16157# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
PROGNOSIS USING SPECTRAL EMBEDDING [PROGNOSE MITTELS SPEKTRALER EINBETTUNG]
F. Schmidt and A. Klos *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 89-93 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16158# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
SYNOPTIC PERTURBATIONS AND CLIMATE [SYNOPTISCHE STOERUNGEN UND KLIMA]
Werner Metz *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 94-97 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16159# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
THE BIMODALITY OF LARGE SCALE AVERAGED FLOW PARAMETERS [ZUR BIMODALITAET GROSSRAEUMIG GEMITTELTER STROEMUNGSPARAMETER]
Heinz-Dieter Schilling *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 98-102 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16160# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
SPECTRAL ANALYSIS OF AN OROGRAPHICALLY STRUCTURED AREA IN THE FOREFIELD OF MESOSCALE FLOW SIMULATIONS [SPEKTRALE ANALYSE EINES OROGRAPHISCH GEGLIEDERTEN GELAENDES IM VORFELD VON MESOSKALIGEN STROEMUNGSSIMULATIONEN]
Sybilla Schmid *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 103-105 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16161# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. Fuer Meteorologie.
OROGRAPHICALLY INFLUENCED COLD FRONTS IN A SPECTRAL APPROACH [OROGRAPHISCH BEINFLUSSTE KALTFRONTEN IN SPEKTRALER BETRACHTUNGSWEISE]
Robert Stanek *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 106-108 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16162# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
SIMULATION OF A LEE CYCLOGENESIS USING A NUMERICAL MODEL [SIMULATION EINER LEEZYKLOGENESE MIT EINEM NUMERISCHEN MODELL]
Arnold Tafferner *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 109-114 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16163# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
NUMERICAL SIMULATION OF THE FLOW ABOUT NEW ZEALAND [UMSTROEMUNG VON NEUSEELAND NUMERISCHE SIMULATION]
Wolfgang Ulrich *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 115-119 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16164# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
CHARACTERISTICS AND CLIMATIC RELEVANCE OF THE ATMOSPHERIC AEROSOL COMPONENTS [DIE ATMOSPHAERISCHEN AEROSOLKOMPONENTEN: CHARAKTERISTIK UND KLIMATISCHE RELEVANZ]
G. A. dAlmeida *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 121-128 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16166# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
NUMERICAL MODELING OF RADIATION FOG [NUMERISCHE MODELLIERUNG VON STRAHLUNGSNEBEL]
Renate Forkel *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 135-143 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16175# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
ANTHROPOGENIC EFFECTS ON THE DROPLET FORMATION PROCESS, AND ION CONCENTRATIONS IN DROPLETS [ANTHROPOGENE EINFLUESSE AUF DEN TROPFENBILDUNGSPROZESS UND IONENKONZENTRATIONEN IN TROPFEN]
Winfried Seidl *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 193-199 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16217# University Coll., London (England). Dept. of Physics and Astronomy.
DEVELOPMENT OF A DOPPLER WIND LIDAR SYSTEM FOR ATMOSPHERIC WIND MEASUREMENTS
D. Rees, I. McWhirter, and D. Wade *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 99-106 (For primary document see N88-16201 08-46)
(Grants AF-AFOSR-0198-85; SGD-10115; PF-273)
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48 OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources.

For related information see also *43 Earth Resources and Remote Sensing.*

N88-16292# European Space Agency, Paris (France).
OCEAN COLOUR WORKSHOP
T. D. Guyenne, ed. Jul. 1987 119 p Workshop held at Villefranche-sur-Mer, France, 5-6 Nov. 1986 Original contains color illustrations
(ESA-SP-1083; ISSN-0379-6566; ETN-88-91135) Copyright Avail: NTIS HC A06/MF A01

The use of ocean color to study biological productivity and biochemical cycles; ocean dynamics and coastal processes; and technical aspects of ocean color remote sensing were discussed. For individual titles, see N88-16293 through N88-16308.

N88-16293# European Space Agency, Paris (France). Earth Observation and Microgravity Directorate.
EUROPE'S POSITION CONCERNING OCEAN COLOUR ACTIVITIES
G. Duchossois *In its* Ocean Colour Workshop Jul. 1987 p 7-8 (For primary document see N88-16292 08-48)
Copyright Avail: NTIS HC A06/MF A01

The NIMBUS-7 Coastal Zone Color Scanner, and the ERS-1 Ocean Color Monitor studies are recalled, and ocean color studies on Columbus are suggested. An imaging spectrometer consisting of a high spatial resolution sensor for local, coastal monitoring, and a medium resolution, large swath instrument for continuous and global monitoring on a daily basis is proposed. It could fly on Polar Platforms. ESA

N88-16294# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Earth Observation Dept.
OVERVIEW OF ESA'S ACTIVITIES IN OCEAN COLOUR REMOTE SENSING
M. Rast and M. Reynolds *In its* Ocean Colour Workshop Jul. 1987 p 9-11 (For primary document see N88-16292 08-48)
Copyright Avail: NTIS HC A06/MF A01

The NIMBUS-7 Coastal Zone Color Scanner, and ERS-1 Ocean Color Monitor studies are recalled, and a pushbroom CCD imaging spectrometer is introduced. Ground pixel size is 300 m, swath width is 1071 km, and it has 8 spectral bands going from 0.4 to 1 micron. Studies on chlorophylls and yellow substances in sea water are mentioned. ESA

N88-16295*# National Aeronautics and Space Administration, Washington, D.C.
UPDATE OF NASA'S OCEAN COLOUR ACTIVITIES
J. A. Yoder *In* ESA, Ocean Colour Workshop Jul. 1987 p 13-15 Original contains color illustrations (For primary document see N88-16292 08-48)
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The NIMBUS-7 Coastal Zone Color Scanner (CZCS) status and processing are reviewed, and future American ocean color instruments are introduced. The CZCS is probably dead, but an attempt to restart it is planned. A wide field instrument for LANDSAT-6 and 7 (WIFS) and a wiskbroom imaging spectrometer (MODIS-T) for Columbus Polar Platforms are outlined. The WIFS and MODIS-T specifications are similar: 64 bands in the range 400 to 1030 nm, with 15 to 30 nm bandwidth; 1 km resolution from 850 km altitude; 64 km footprint along track; 1500 km scan across track; and 10 yr continuous operation life. ESA

N88-16296# Marine Biological Association of the United Kingdom, Plymouth (England).
REMOTE SENSING OF OCEAN COLOUR FOR STUDIES OF BIOLOGICAL PRODUCTIVITY AND BIOCHEMICAL CYCLES
P. M. Holligan and A. Morel (Laboratoire d'Oceanographie Physique, Paris, France) *In* ESA, Ocean Colour Workshop Jul. 1987 p 19-22 Original contains color illustrations (For primary document see N88-16292 08-48)
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The use of ocean color to assess marine biological resources, to study photosynthetic processes (biomass primary production), and to follow biogeochemical cycles (such as CO_2 exchange between atmosphere and ocean, and phytoplankton effects on the carbon cycle) is discussed. Aerosol and sediment studies using narrow band visible scanners such as the Coastal Zone Color Scanner to examine materials exchange are mentioned. Steps which must be taken to exploit ocean color imagery in prediction of global environmental change are listed. ESA

N88-16297# Southampton Univ. (England). Dept. of Oceanography.
OCEAN COLOUR APPLICATIONS IN OCEAN DYNAMICS AND COASTAL PROCESSES
I. S. Robinson and D. Spitzer (Ministry of Transport and Waterways, The Hague, Netherlands) *In* ESA, Ocean Colour Workshop Jul. 1987 p 23-26 (For primary document see N88-16292 08-48)
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Use of ocean color as a tracer of ocean dynamics, in climate studies, and in coastal bathymetry was reviewed. Ideal spatial and temporal resolutions for studies of ocean basin circulation, mesoscale phenomena (ocean fronts and eddies), shelf sea processes, coastal and beach processes, and estuarine dynamics were established. Priority sensor requirements are for a medium resolution ocean color instrument for ocean, mesoscale, and shelf sea dynamics (Columbus Polar Platform) and a high resolution color sensor for coastal and estuarine studies (not necessarily a marine-dedicated instrument). ESA

N88-16298# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
TECHNICAL ASPECTS OF FUTURE OCEAN COLOUR REMOTE SENSING
M. Rast *In its* Ocean Colour Workshop Jul. 1987 p 27-28 (For primary document see N88-16292 08-48)
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Performance requirements for a Polar Platform Ocean color sensor are given. Spatial resolution = 0.5 x 0.5 km; swath width is at least 1500 km; spectral bandwidth = 10 nm (nominal) 5 nm (goal); radiometric resolution = 12 bit; q spectral bands minimum (visible/near infrared); global daily coverage; tilt mode to avoid sunlight; sensitivity sufficient for low reflecting targets (e.g., ocean surface at high latitude) in order to get data at low solar illumination

conditions; and it is essential that the sensor is insensitive to polarization conditions of scattered light. ESA

N88-16299# Joint Research Centre of the European Communities, Ispra (Italy).
STATUS AND PROSPECTS OF THE JOINT RESEARCH COMMITEE (JRC) WORK ON THE APPLICATION OF OCEAN COLOUR MONITORING FROM SPACE
B. Sturm, A. Beckering, G. Fraysse, S. GallideParatesi, B. M. Henry, G. Maracci, L. Nykjaer, P. Schlittenhardt, and S. Tassan *In* ESA, Ocean Colour Workshop Jul. 1987 p 35-46 (For primary document see N88-16292 08-48)
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The status of activity on ocean color analysis is given. The main achievements are an operational software package for the evaluation of CZCS data and site specific interpretation algorithms for case 2-type water of the Northern Adriatic Sea which allow the elaboration of geometrically corrected maps of pigment and total suspended matter concentrations and of diffuse attenuation coefficient. Applying these techniques to an extensive archive of CZCS data from the Adriatic Sea, the ultimate goal is to assess remote sensing of anthropogenic pollutants; and to develop a methodology to predict the movement and dispersion of pollutants in estuarine and coastal zones. ESA

N88-16300# Institute of Ocean Sciences, Sidney (British Columbia).
CANADIAN ACTIVITIES AND GOALS IN REMOTE SENSING OF OCEAN COLOUR AND FLUORESCENCE FROM SPACE
J. F. R. Gower *In* ESA, Ocean Colour Workshop Jul. 1987 p 41-48 Original contains color illustrations (For primary document see N88-16292 08-48)
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Uses of ocean color remote sensing in oceanography, fisheries research and management, coastal zone mapping, and bathymetry are described. The importance of this work, and the development of an airborne phytoplankton mapping technique based on solar-stimulated chlorophyll fluorescence, led to development of an imaging spectrometer as a prototype satellite sensor. Results from this instrument are shown. Examples of airborne hydrography with passive and active sensors are also presented. ESA

N88-16301# Geneva Univ. (Switzerland). Dept. de Geologie et de Paleontologie.
RESEARCH IN SWITZERLAND ON OCEAN AND INLAND-WATER COLOUR MONITORING
J.-M. Jaquet *In* ESA, Ocean Colour Workshop Jul. 1987 p 49-52 Original contains color illustrations (For primary document see N88-16292 08-48)
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Research in water color monitoring is reviewed. The development of algorithms addressing the complexity of inland waters is discussed. ESA

N88-16302# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Optoelektronik.
FEDERAL REPUBLIC OF GERMANY'S INTERESTS, ACTIVITIES AND GOALS IN REMOTE SENSING OF OCEAN COLOUR/FLUORESCENCE FROM SPACE
H. vanderPiepen *In* ESA, Ocean Colour Workshop Jul. 1987 p 53-58 Original contains color illustrations (For primary document see N88-16292 08-48)
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Scientific research an technical developments concerning natural fluorescence in context of with an ocean color monitor as payload on the polar platforms of the Columbus program are reviewed. Application programs, scientific and user communities, and government involvement in oceanography are described. ESA

N88-16303# Centre National d'Etudes Spatiales, Paris (France).
FRENCH ACTIVITIES IN OCEAN COLOUR OBSERVATIONS
J.-L. Fellous and A. Morel *In* ESA, Ocean Colour Workshop Jul. 1987 p 59-69 Original contains color illustrations (For primary document see N88-16292 08-48)
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The use of CZCS data as well as AVHRR and high resolution LANDSAT-TM and SPOT imagery in ocean color studies is reviewed. Main research programs and experiments are coordinated with international efforts such as TOGA, WOCE, and GOFS. Plans to fly a large-swath visible and near IR sensor (named Vegetation) on the remote sensing satellite SPOT-4 (mid-1992) for vegetation and ocean color monitoring are revealed. ESA

N88-16304# Consiglio Nazionale delle Ricerche, Venice (Italy). Lab. per lo Studio della Dinamica delle Grande Masse.
ITALIAN ACTIVITIES IN OCEAN COLOUR REMOTE SENSING
R. Frassetto and L. Pantani (Consiglio Nazionale delle Ricerche, Florence, Italy) *In* ESA, Ocean Colour Workshop Jul. 1987 p 71-72 Original contains color illustrations (For primary document see N88-16292 08-48)
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The potential of ocean color remote sensing over coastal and offshore areas of Italy in providing valuable information for planning and decision making of public administrative agencies is demonstrated. The principal interest is in pollution monitoring, including thermal pollution near shore and in forecast of eutrophication. Technological research is directed to the development of instruments for in-situ or airborne measurements in air and water. User activity and interests in ocean color are described. ESA

N88-16305# Ministry of Transport and Waterways, The Hague (Netherlands). Tidal Waters Div.
NATIONAL REMOTE SENSING PROGRAM (NRSP) OF THE NETHERLANDS **c43**
D. Spitzer *In* ESA, Ocean Colour Workshop Jul. 1987 p 83-90 Sponsored by the Netherlands Remote Sensing Board, the National Aerospace Lab. and Netherlands Inst. for Sea Research Original contains color illustrations (For primary document see N88-16292 08-48)
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Structure and organization of remote sensing are outlined. Priorities and projects are mentioned with respect to operationalization, commercialization, applied and fundamental research, technology development, and infrastructure. Progress in remote sensing of ocean color is highlighted. Applications of the pushbroom airborne scanner CAESAR having spectral characteristic similar to the OCM, including the fluorescence channels, are emphasized. Underwater and low altitude radiometers were developed allowing an improved interpretation of the remotely sensed imagery. ESA

N88-16306# Southampton Univ. (England). Dept. of Oceanography.
DEVELOPMENTS IN OCEAN COLOUR RESEARCH IN THE UNITED KINGDOM
I. S. Robinson and P. M. Holligan (Marine Biological Association of the United Kingdom, Plymouth, England) *In* ESA, Ocean Colour Workshop Jul. 1987 p 91-99 Original contains color illustrations (For primary document see N88-16292 08-48)
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Requirements for ocean color sensors are outlined. Coordinated programs for marine science, having an ocean color component, are mentioned. Details of the Ocean Fluxes study are given. ESA

N88-16307# GKSS-Forschungszentrum Geesthacht (West Germany).
THE USE OF CHLOROPHYLL FLUORESCENCE MEASUREMENTS FROM SPACE FOR SEPARATING CONSTITUENTS OF SEA WATER
H. Grassl *In* ESA, Ocean Colour Workshop Jul. 1987 p 103-109 (For primary document see N88-16292 08-48)
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Remote sensing of chlorophyll-a is reviewed. Chlorophyll-a shows a Sun stimulated fluorescence line peaking at 685 nm wavelength. This spectral feature is detectable from airplanes at all chlorophyll-a concentrations at least down to a chlorophyll-a content of 1 g/cum, also in turbid coastal waters. For space applications absorption by atmospheric gases for wavelengths above 688 nm forces a fluorescence channel to the shortwave part of the fluorescence line. The influence of nonchlorophyllous suspensions and of Gelbstoff on fluorescence is small. Fluorescence efficiency dependence on insolation is small at Sun elevations above 20 to 30 deg, the typical remote sensing conditions. Recommendations for a space application are listed. ESA

N88-16308# GKSS-Forschungszentrum Geesthacht (West Germany).
THE INFLUENCE OF YELLOW SUBSTANCES ON REMOTE SENSING OF SEA-WATER CONSTITUENTS FROM SPACE
H. Grassl *In* ESA, Ocean Colour Workshop Jul. 1987 p 111-118 Original contains color illustrations (For primary document see N88-16292 08-48)
(Contract ESA-RFQ-3-5060/84-NL-MD)
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Gelbstoff influence on upward radiance spectra at the surface as well as at satellite altitude, and on the use of Gelbstoff as a tracer for salinity were studied. Results show that only inverse modeling using absolutely calibrated multichannel radiance values is able to separate Gelbstoff from phytoplankton and suspended matter, and that Gelbstoff is stable enough to be used as a tracer for salinity in coastal waters as long as the riverine concentration is known. Recommendations for a satellite Gelbstoff sensor are made. ESA

N88-16309# Woods Hole Oceanographic Institution, Mass.
INTERPRETATION OF EQUATORIAL CURRENT METER DATA AS INTERNAL WAVES Ph.D. Thesis
M. B. Blumenthal Jan. 1987 380 p Prepared in cooperation with Massachusetts Inst. of Tech., Cambridge, NSF, Washington, D.C., and ONR, Arlington, Va.
(PB88-108113; WHOI-87-7) Avail: NTIS HC A17/MF A01 CSCL 08C

Garrett and Munk use linear dynamics to synthesize frequency-wavenumber energy spectra of internal waves (GM72, GM75, GM79). The search for deviations from the GM models is continued. It has three advantages over earlier work: extensive data from an equatorial region, long time series (2 years), and relatively sophisticated linear internal wave models. The internal wave models include several important extensions to the GM models; horizontal anisotropy and vertical asymmetry, resolution between standing models and propagating waves, general vertical structure, and kinematic effects of mean shear flow. Also investigated are the effects of scattering on internal waves, effects that are especially strong on the equator because the buoyancy frequency variability is a factor of ten higher than at mid-latitudes. GRA

N88-16310# Washington Univ., Seattle. School og Oceanography.
NORTH PACIFIC OCEAN. SUBTROPICAL FRONT NORTH OF HAWAII, R/V THOMAS G. THOMPSON: 7 JANUARY - 10 FEBRUARY 1974. CTD DATA REPORT
Gunnar I. Roden and William J. Fredericks 1987 527 p
(Contracts N00014-75-C-0502; N00014-84-C-0111)
(AD-A186565; CONTRIB-1720) Avail: NTIS HC A23/MF A01 CSCL 08C

During January and February 1974 scientists aboard the R/V Thomas G. Thompson studied the thermohaline and density structures in the subtropical frontal zone of the central North Pacific. Of the 261 CTD stations planned, 257 were completed and 4 were lost due to weather. The primary objectives of the field study in the central North Pacific were: 1) to investigate the three dimensional thermohaline and density structure in the subtropical frontal zone by means of high resolution sections; 2) to determine the mesoscale baroclinic flow field in the subtropical frontal zone; 3) to study the mesoscale dynamic height perturbations and the mesoscale thermohaline structure along 1400 km long sections north and east of Hawaii; 4) to assess the mesoscale thermohaline and baroclinic flow variability in the vicinity of the Hawaiian ridge. Oceanographic fronts; Winter. GRA

N88-16311# Washington Univ., Seattle. School of Oceanography
NORTH PACIFIC OCEAN. TRADEWIND REGION EAST OF HAWAII, R/V THOMAS G THOMPSON: 25 SEPTEMBER - 1 NOVEMBER 1972. STD DATA REPORT
Gunnar I. Roden and William J. Fredericks 1987 619 p
(Contracts N00014-67-A-0103; N00014-84-C-0111)
(AD-A186566; CONTRIB-1719) Avail: NTIS HC A99/MF A01 CSCL 08C

During September and October 1972, scientists aboard the R/V Thomas G. Thompson studied the thermohaline and density structures in the tradewind region east of the Hawaiian Islands. An additional hydrographic section was made from the working area to San Diego, Ca. A total of 300 stations were taken. The primary objectives of the field study in the tradewind region east of Hawaii were: 1) to investigate the mesoscale thermohaline and density structures in 2700 km high resolution sections across the tradewind region; 2) to determine the subtropical and doldrum fronts occuring at the boundaries of this region; 3) to study the mesoscale dynamic height and baroclinic flow perturbations in the tradewind region; and 4) to assess the mesoscale and baroclinic flow structures across the California current between the subtropical gyre and the coast. GRA

N88-16312# Washington Univ., Seattle. School of Oceanography.
NORTH PACIFIC OCEAN. SUBARCTIC FRONT CENTRAL PACIFIC, R/V THOMAS G. THOMPSON: 8 SEPTEMBER - 9 OCTOBER 1975. CTD DATA REPORT
Gunnar I. Roden and William J. Fredericks 1987 586 p
(Contracts N00014-75-C-0502; N00014-84-C-0111)
(AD-A186567; CONTRIB-1721) Avail: NTIS HC A25/MF A01 CSCL 08C

During September and October 1975 scientists aboard the R/V Thomas G. Thompson studied the thermohaline and density structures in the subarctic frontal area to the central North Pacific. In addition, high resolution hydrographic sections were made from Cape Flattery to the working area and from the working area to Kahuku Point, Oahu. Of the 287 CTD stations planned, 286 were completed, one was lost due to weather. The primary objectives of the field study were: 1) to investigate the three-dimensional thermohaline and density structure in the subarctic frontal zone by means of high resolution sections; 2) to determine the mesoscale baroclinic flow field in the subarctic frontal zone; 3) to study the mesoscale dynamic height perturbations and the mesoscale thermohaline structure along a 2700 km long section north of Oahu; and 4) to assess the mesoscale thermohaline and baroclinic flow variability in the vicinity of the Hawaiian Ridge. GRA

N88-16313# Washington Univ., Seattle. School of Oceanography.
NORTH PACIFIC OCEAN. NORTHWEST PACIFIC TRANSITION ZONE, R/V THOMAS G. THOMPSON: 19 MARCH - 1 MAY 1971. STD DATA REPORT
Gunnar I. Roden and William J. Fredericks 1987 539 p
(Contracts N00014-67-A-0103; N00014-84-C-0111)
(AD-A186568; CONTRIB-1718) Avail: NTIS HC A23/MF A01 CSCL 08C

During March and April 1971 scientists aboard the R/V Thomas G. Thompson studied the thermohaline and density structures in the subarctic-subtropical transition zone of the northwestern Pacific. A total of 270 STD stations were taken. Heavy weather prevented taking stations north of latitude 43 N. The primary objectives of the field study in the northwestern Pacific were: 1) to investigate the mesoscale thermohaline and density structures in 2700 km long high resolution sections across the subarctic and subtropical

boundaries; 2) to determine the mesoscale signatures of the subarctic and subtropical fronts at the end of the winter season; 3) to study the mesoscale dynamic height and baroclinic flow structures across the subarctic-subtropical transition zone; and 4) to assess the thermohaline variability in the Oyashio region off northeastern Japan. GRA

N88-16314# Washington Univ., Seattle. School of Oceanography.
NORTH PACIFIC OCEAN. GULF OF ALASKA, R/V THOMAS G. THOMPSON: 1 FEBRUARY - 8 MARCH 1967. STD DATA REPORT
Gunnar I. Roden and William J. Fredericks 1987 171 p
(Contracts N00014-67-A-0103; N00014-84-C-0111)
(AD-A186569; CONTRIB-1715) Avail: NTIS HC A08/MF A01 CSCL 08C

During Jan and Feb 1967, scientists aboard the R/V Thomas G. Thompson studied the thermohaline and density structures in the northern Gulf of Alaska. A total of 77 STD stations were taken, mostly north of latitude 53 N. The primary objectives of the field study were: 1) to investigate the mesoscale thermohaline and density structures associated with the subarctic gyre; 2) to determine the baroclinic flow and transports associated with this gyre; 3) to study the structure and extent of the upwelling dome related to the cyclonic circulation; and 4) to investigate the magnitude and distribution of temperature inversions during the winter season. GRA

N88-16315# Naval Postgraduate School, Monterey, Calif.
PREDICTABILITY OF ICE CONCENTRATION IN THE HIGH-LATITUDE NORTH ATLANTIC FROM STATISTICAL ANALYSIS OF SST (SEA SURFACE TEMPERATURE) AND ICE CONCENTRATION DATA M.S. Thesis
Gordon H. Fleming Sep. 1987 143 p
(AD-A186621) Avail: NTIS HC A07/MF A01 CSCL 08L

A statistical analysis of 27 years of monthly averaged sea surface temperature (SST) and ice concentration data was conducted for 17 locations along the annual mean position of the marginal ice zone spanning the North Atlantic. Anomalies (differences from monthly means) of both variables were observed to have spatial scales of 100s to 1000s of kms, temporal scales of 6 months to several years, and a strong regional dependence. Sea surface temperature autocorrelation values were in general higher than ice concentration autocorrelation values. Cross-correlations between the two variables were found to be highly significant in some regions and poor in others. The various correlation features appeared in plausible with respect to understood physical processes in each region. Statistical analyses of large, homogeneous data sets as conducted in this study appear to be superior to current thermodynamic models in their potential for long-range forecasts of ice concentration. Author

N88-16120# Joint Publications Research Service, Arlington, Va.
UPPER MANTLE HETEROGENEITY AND COMPOSITION OF PRIMARY OCEAN ISLAND MAGMAS Abstract Only
L. N. Kogarko *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 6 Transl. into ENGLISH from Geologiya i Geofizika (Novosibirsk, USSR), no. 7, Jul. 1986 p 74-80 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16121# Joint Publications Research Service, Arlington, Va.
OCEAN FLOOR MAGMATISM AND PROBLEMS OF LITHOSPHERE FORMATION Abstract Only
L. V. Dmitriyev *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 7 Transl. into ENGLISH from Geologiya i Geofizika (Novosibirsk, USSR), no. 7, Jul. 1986 p 81-85 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16122# Joint Publications Research Service, Arlington, Va.
NATURE OF WESTERN PACIFIC TRANSITION ZONE Abstract Only
V. I. Ilichev and Yu. V. Shevaldin *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 8 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 290, no. 3, Sep. 1986 p 570-573 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16123# Joint Publications Research Service, Arlington, Va.
NEW DATA ON STRUCTURE OF EARTH'S CRUST AND SEISMICITY OF BASINS IN ATLANTIC AND INDIAN OCEANS Abstract Only
Yu. P. Neprochnov, V. V. Sedov, A. A. Pokryshkin, L. G. Akentyev, B. N. Grinko, A. A. Ostrovskiy, and B. V. Kholopov *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 10 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 290, no. 6, Oct. 1986 p 1448-1453 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16125# Joint Publications Research Service, Arlington, Va.
NEOGENE PALEOCLIMATE IN PACIFIC OCEAN SUBARCTIC REGION DETERMINED FROM STUDY OF DIATOMS Abstract Only
T. V. Oreshkina *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 15-16 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Seriya Geologicheskaya (Moscow, USSR), no. 11, Nov. 1986 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16126# Joint Publications Research Service, Arlington, Va.
SEA RESONANCE VIBRATIONAL SOURCE OF SEISMIC WAVES Abstract Only
G. V. Yegorov and A. A. Zuyev *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 16-17 Transl. into ENGLISH from Geologiya i Geofizika (Novosibirsk, USSR), no. 9, Sep. 1986 p 111-115 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

51 LIFE SCIENCES (GENERAL)

N88-16316# United Nations Industrial Development Organization, Vienna (Austria).
SAFETY GUIDELINES AND PROCEDURES FOR BIOSCIENCE-BASED INDUSTRY AND OTHER APPLIED MICROBIOLOGY
23 Apr. 1986 19 p Presented at informal UNIDO/WHO/UNEP Working Group on Biotechnology Safety, Vienna, Austria, 27-29 Jan. 1986
(PB87-140521; UNIDO-ID/WG.463/1) Avail: NTIS HC E02/MF E01 CSCL 06B

The United Nations Industrial Development Organization (UNIDO) publication on industrial safety for biotechnology research and development and applied microbiology covers the following topics: (1) project objectives; (2) risk and risk assessment, the IBRD guidelines, the World Health Organization classification system; and (3) conjectural risks associated with applied biotechnology. GRA

N88-16317*# Lockheed Engineering and Management Services Co., Inc., Washington, D.C.
USSR SPACE LIFE SCIENCES DIGEST, ISSUE 14
Lydia Razran Hooke, Ronald Teeter, Mike Radtke, and Joseph Rowe (Library of Congress, Washington, D. C.) Washington, D.C. NASA Feb. 1988 110 p
(Contract NASw-4292)
(NASA-CR-3922(16); NAS 1.26:3922(16)) Avail: NTIS HC A06/MF A01 CSCL 06B

This is the fourteenth issue of NASA's USSR Space Life Sciences Digest. It contains abstracts of 32 papers recently published in Russian language periodicals and bound collections and of three new Soviet monographs. Selected abstracts are

illustrated with figures and tables from the original. Also included is a review of a recent Soviet conference on Space Biology and Aerospace Medicine. Current Soviet life sciences titles available in English are cited. The materials included in this issue have been identified as relevant to the following areas of aerospace medicine and space biology: adaptation, biological rhythms, body fluids, botany, cardiovascular and respiratory systems, developmental biology, endocrinology, enzymology, equipment and instrumentation, gastrointestinal systems, habitability and environment effects, human performance, immunology, life support systems, mathematical modeling, metabolism, musculoskeletal system, neurophysiology, nutrition, operational medicine, perception, personnel selection, psychology, radiobiology, and space biology and medicine. Author

N88-16318# Joint Publications Research Service, Arlington, Va.
USSR REPORT: LIFE SCIENCES. BIOMEDICAL AND BEHAVIORAL SCIENCES
5 Dec. 1986 121 p Transl. into ENGLISH from various Russian articles
(JPRS-UBB-86-022) Copyright Avail: NTIS HC A06/MF A01

Articles from the open literature are summarized in the areas of aerospace medicine, agrotechnology, biochemistry, biophysics, biotechnology, environment, epidemiology, genetics, immunology, laser bioeffects, marine mammals, medicine, microbiology, military medicine, molecular biology, pharmacology and toxicology, physiology, public health, radiation biology, veterinary medicine, and psychiatric conferences. For individual titles, see N88-16319 through N88-16324.

N88-16319# Joint Publications Research Service, Arlington, Va.
POSSIBLE USE OF PLASMIDS FOR STUDY OF EFFECT OF SPACE FLIGHT FACTORS ON BIOLOGICAL OBJECTS
S. N. Zaloguyev, A. F. Moroz, L. I. Glatman, A. A. Terekhov, N. G. Antsiferova, V. L. Popov, F. M. Kirillova, L. N. Kats, M. P. Bragina, and V. M. Shilov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences 5 Dec. 1986 p 1-9 Transl. into ENGLISH from Antibiotiki i Meditsinskaya Biotekhnologiya (Moscow, USSR), no. 5, May 1986 p 357-362 (For primary document see N88-16318 08-51)
Copyright Avail: NTIS HC A06/MF A01

In order to ascertain the effects of space flight on bacterial resistance to antibiotics, the effect of space flight factors on the phenotype and certain molecular-genetic plasmid parameters in E. coli strains whose growth and reproduction occurred in Earth orbit was studied. Plasmids were selected so that there would be representatives of various classes (R, Col, Hdl and others) that differed in molecular weight, degree of conjugation, and origin. An absence of any changes in the properties of the plasmid-coded strains and the strains of the flight experiment agrees well with the results of a study of the plasmid composition of strains that were obtained in an electrophoretic analysis of plasmid DNA. A comparison of the electrophoregrams shown in the diagram convincingly demonstrates the complete likeness of the plasmid profiles of flight and synchronous experimental strains that carry the same number of plasmids with unchanged molecular weights. In short, data indicate that the space flight factors active under the experimental conditions for a period of 24 hours did not have any effect on the examined properties of the tested strains and their plasmids. J.P.B.

N88-16320# Joint Publications Research Service, Arlington, Va.
ZERO GRAVITY AND LIVING ORGANISM Abstract Only
In its USSR Report: Life Sciences. Biomedical and Behavioral Sciences 5 Dec. 1986 p 10 Transl. into ENGLISH from Tass (Moscow, USSR), 31 Jul. 1986 (For primary document see N88-16318 08-51)
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It is established that zero gravity can cause structural changes in cells. Such changes have been detected for the first time in tissues of tradescantia during the plant's lengthy stay on a space flight. Such changes had not been registered on Earth even when tissues were subjected to radiation, vibration or fluctuations in temperature. The results of the experiments were confirmed by numerous experiments on other experimental specimens. Zero gravity has an unfavorable effect not only on mitosis. It causes unpleasant blood surges to the head in cosmonauts and changes in the state of the cardiovascular system and metabolism. Soviet scientists have developed preventive measures against the unfavorable influence of zero gravity on living organisms. As a result, periods of man's stay in space have increased. Author

N88-16321# Joint Publications Research Service, Arlington, Va.
BIORHYTHMIC ASPECTS OF INTERCONTINENTAL ANTARCTIC ADAPTATION
A. L. Maksimov and T. B. Chernook *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences 5 Dec. 1986 p 72-78 Transl. into ENGLISH from Izvestiya Akademii Nauk Kirgizskoy SSR (Frunze, USSR), no. 2, Mar. - Apr. 1986 p 35-39 (For primary document see N88-16318 08-51)
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A comparative study of human circadian rhythm was carried out in order to clarify the question of whether a stable adaptation phase occurs in polar research workers after six months of wintering at an Antarctic high altitude polar station, as well as to evaluate the rearrangement in the biorhythmic structure. In the mid-winter polar night, considerable changes were noted in the biorhythmic indicators with respect to the periodic organization and pulse-amplitude characteristics. In the same period there was an inversion in pulse rate rhythm, ultradianal circadian rhythms appeared, and a maximum in the rate of cardiac contractions coincided with a minimum sodium retention in saliva, attesting to the activation of the sympathoadrenal system during night rest. No 24- or 12-hour rhythms were revealed with respect to the temperature indicator and a considerable flattening of the diurnal curve of the body temperature occurred. Potassium and sodium excretion from saliva was characterized by a great value spread over 24 hours and the appearance of a 12-hour ultradianal rhythm. In conclusion, no stable adaptation phase was found in the subjects, evidently as a result of extreme winter conditions. J.P.B.

N88-16322# Joint Publications Research Service, Arlington, Va.
NEUROCHEMICAL CHANGES IN HIBERNATION Abstract Only
E. Z. Emirbekov and S. P. Lvova *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences 5 Dec. 1986 p 79 Transl. into ENGLISH from Neyrokhimiya (Yerevan, USSR), no. 3, Jul. - Sep. 1984 p 306-317 (For primary document see N88-16318 08-51)
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A brief literature review is presented on the data accumulated in the neurochemical literature on biochemical changes in the brain during hibernation. It has been shown, for example, that during hibernation many of the oxidative enzymes and flavin-dependent dehydrogenases evidence high levels of activity, whereas the phylogenetically newer elements, such as the cytochrome oxidases, are present with diminished activity. In conjunction with these observations, the cortex has been shown to be unusually susceptible to cyanides during hibernation. With hibernation, serotonin levels show elevation while catecholamines show concomitant depression, a process reversed on waking, with the actual changes suggesting profound alterations in the thermoregulatory center. However, despite the facts and figures that have been accumulated, these quantitative data are not yet sufficient to formulate an unequivocal concept of hibernation. Author

N88-16323# Joint Publications Research Service, Arlington, Va.
EFFECTS OF EXTREME HYPOXIA ON PHOSPHOLIPID METABOLISM IN SUBCELLULAR STRUCTURES OF RAT BRAIN Abstract Only
S. V. Gasteva, T. Ye. Rayze, and L. M. Sharagina *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences 5 Dec. 1986 p 80 Transl. into ENGLISH from Neyrokhimiya (Yerevan, USSR), no. 3, Jul. - Sep. 1984 p 284-287 (For primary document see N88-16318 08-51)
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Wistar rats were employed in a study designed to ascertain the effects of moderate and extreme hypoxia on the status of phospholipid metabolism in the cerebral hemispheres. Maintenance of the animals in a pressure chamber at 266.90 gPa for 2 hours, with periodic reduction to 213.38 gPa, resulted in profound reduction in phospholipid turnover and 40 to 45 percent reduction of the phospholipid levels in the mitochondria and synaptosomes. The reduction in the concentration of the phospholipids in the myelin, cytosol and microsomes ranged from ca. 10 to 20 percent. Exposure to moderate hypoxia (266.60 gPa) led to a similar depression of the turnover rate, but with no decrease in the levels of the phospholipids. The data were interpreted to indicate that moderate hypoxia depressed phospholipid anabolism and catabolism to an equal extent, whereas extreme hypoxia led largely to inhibition of the biosynthesis of phospholipids in the cerebral hemispheres. Author

N88-16324# Joint Publications Research Service, Arlington, Va.
GENERAL BIOLOGICAL CHARACTER OF ADAPTIVE CAPACITY OF MAMMALIAN METABOLISM IN RESPONSE TO DIVERSE AND EXTREME ENVIRONMENTAL FACTORS Abstract Only **c52**
B. M. Grayevskaya and N. N. Zolotareva *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences 5 Dec. 1986 p 81 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 289, no. 1, Jul. 1986 p 250-252 (For primary document see N88-16318 08-51)
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Biochemical studies were conducted to determine optimal metabolic parameters delineating resistance to diverse and extreme environmental factors in mammals. Preliminary studies with two lines of mice (BALB/c and C57B1) differing in susceptibility to ionizing radiation demonstrated that blood glucose levels and changes in the level following epinephrine administration are indicative of adaptation, and reflect the status of the sympathetic nervous system. Within a given line of mice, the socially dominant individuals showed greater adaptability to stress and survivability. Data derived for several mammalian species showed that, on the basis of blood glucose levels and response to epinephrine challenge, susceptibility to environmental stress can be predicted with an accuracy of 80 percent on an individual basis. Optimal blood glucose levels and 15 and 30 minute glycemic responses to epinephrine are tabulated for humans, cattle, rats, mice, and dolphins. Author

N88-16096# Joint Publications Research Service, Arlington, Va.
SPACE BIOLOGY AND MEDICINE
A. I. Grigoryev *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 86-94 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow, USSR), no. 2, Mar. - Apr. 1987 p 34-39 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16097# Joint Publications Research Service, Arlington, Va.
RESULTS OF RESEARCH WITH BIOLOGICAL SATELLITES Abstract Only
G. Lomanov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 95 Transl. into ENGLISH from Sotsialisticheskaya Industriya (Moscow, USSR), 18 Sep. 1987 p 4 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16098# Joint Publications Research Service, Arlington, Va.
RESEARCH ON COTTON PLANTS GROWN IN SPACE
In its JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 98 Transl. into ENGLISH from Pravda Vostoka (Tashkent, USSR), 22 Jul. 1987 p 3 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16262# Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Biochemie.
LIFE SCIENCES EXPERIMENTS ON STRATOSPHERIC BALLOONS AND SOUNDING ROCKETS
C. Wiese, B. Bechler, F. K. Gmuender, G. Lorenzi, and A. Cogoli *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 371-376 Sponsored by the Swiss Federal Inst. of Technology Board (For primary document see N88-16201 08-46)
(Grant SNSF-3.382-0.82)
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N88-16263# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
THE D-1 BIORACK RESULTS: A BASE FOR FURTHER SPACE BIOLOGICAL INVESTIGATIONS
D. A. M. Mesland *In its* Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 377-382 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

N88-16264# University Hospital, Copenhagen (Denmark). Inst. of Aerospace Medicine.
SCIENTIFIC OBJECTIVES AND FUNCTIONAL REQUIREMENTS OF LIFE SCIENCES IN THE SPACE STATION
F. Bonde-Petersen *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 383-385 (For primary document see N88-16201 08-46)
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N88-16266# Centre National d'Etudes Spatiales, Paris (France).
CONTRIBUTION OF STRATOSPHERIC BALLOON FLIGHTS IN SPACE BIOLOGY
K. Bost, R. Tixador, G. Richoilley, M. Delpoux, G. Perbel, A. Cogoli, and C. Nogues (Centre d'Enseignement et de Recherches de Medecine Aeronautique, Paris, France) *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 391-394 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

N88-16325# Army Research Inst. of Environmental Medicine, Natick, Mass.
DEXAMETHASONE AS PROPHYLAXIS FOR ACUTE MOUNTAIN SICKNESS: EFFECT OF DOSE LEVEL
Paul B. Rock, T. S. Johnson, Richard F. Larsen, Charles S. Fulco, and Laurie A. Trad 1 Jun. 1987 22 p
(AD-A185848) Avail: NTIS HC A03/MF A01 CSCL 06E

Rapid exposure of unacclimatized individuals to high altitude causes a syndrome termed acute mountain sickness (AMS). Prophylactic treatment with high doses of dexamethasone is known to prevent AMS, but carries a high risk of side effects. To determine whether lower doses with less potential for side effects were effective in preventing AMS, 28 men between the ages of 18 and 32 were exposed to a simulated altitude of 4579 m for 45 h in a hypobaric chamber on two occasions while taking one of three doses of dexamethasone (4 mg, 1 mg or .25 mg every twelve hours) or a placebo in a double-blind, crossover design. Three independent measures for the presence of AMS showed that the 4 mg dose of dexamethasone reduced the incidence of AMS symptoms compared to placebo and compared to the other dose levels. Dexamethasone did not alter fluid balance or plasma volume changes, but treatment with 1 mg and 4 mg suppressed cortisol

secretion. There was no evidence of adrenal cortical suppression after treatment with dexamethasone or placebo 48 h after discontinuing altitude exposure and drug treatment. The results indicate that doses of dexamethasone less than 4 mg twice daily may not be effective prophylactic treatment for AMS. GRA

N88-16326# Army Research Inst. of Environmental Medicine, Natick, Mass.
PREDICTION OF HUMAN THERMOREGULATORY RESPONSES AND ENDURANCE TIME IN WATER AT 20 AND 24C
Peter Tikuisis, Richard R. Gonzalez, and Kent B. Pandolf 24 Jun. 1987 26 p
(AD-A186223) Avail: NTIS HC A03/MF A01 CSCL 06J

A multi-compartmental mathematical model for predicting human thermoregulatory responses was applied to immersion in moderately cold water. Data were obtained from experiments where eight healthy male volunteers were immersed nude and up to the neck for 1 h in water at 20 and 24 degrees C under conditions of rest and exercise. Rectal temperature and metabolic rate were measured before and during immersion. Once agreement between the model prediction and experimental observation was obtained, the model was used for prediction beyond the duration of the experiment. Stabilization of core temperature was predicted after 4-5 h of immersion for rest and after 2-4 h for exercise. Stabilization for resting individuals has been observed in other experiments under similar conditions. These results suggest that linear extrapolations based on linear body cooling rates are inadequate for predicting endurance times in moderately cold water. In this study, predicted endurance times were based on the concept of relative exercise intensity and are in agreement with the limited data available. GRA

N88-16327# Army Research Inst. of Environmental Medicine, Natick, Mass.
EXERCISE THERMOREGULATION AFTER PROLONGED WAKEFULNESS
Peter Tikuisis, Richard R. Gonzalez, and Kent B. Pandolf Jun. 1987 23 p
(AD-A186224) Avail: NTIS HC A03/MF A01 CSCL 06J

The effect of 33 hours wakefulness on the control of forearm cutaneous blood flow and forearm sweating during exercise was studied in three men and three women (follicular phase of the menstrual cycle). Subjects exercised for 30 min at 60% peak VO2 while seated behind a cycle ergometer. Esophageal temperature (Tes), mean skin temperature (Tsk), and arm sweating to Tes tended to be lower, but was not significant. Arm skin temperature was not different between control and sleep loss experiments. Reflex cutaneous vasodilation during exercise appears to be reduced by both central and local factors following 33 hours of wakefulness. GRA

N88-16328# Army Research Inst. of Environmental Medicine, Natick, Mass.
EVIDENCE FOR HUMAN ADAPTIVE RESPONSE TO DEHYDRATION: INCREASE OF CIRCULATING PROTEIN MASS
Michael N. Sawka and C. B. Wenger Jun. 1987 9 p
(AD-A186225) Avail: NTIS HC A02/MF A01 CSCL 06J

Previously, it was believed that humans do not adapt to dehydration. Data are presented here showing that within 15 hours after dehydration is reached, humans increase circulating protein mass to facilitate the redistribution of body water from the interstitial to the intravascular space. The increased resting circulating protein mass may also provide an advantage during situations in which dehydrated individuals have difficulty retaining their circulating protein, such as exercise in heat. GRA

N88-16329# Army Research Inst. of Environmental Medicine, Natick, Mass.
RATIONAL CONSIDERATIONS FOR MODELLING HUMAN THERMOREGULATION DURING COLD WATER IMMERSION
Peter Tikuisis and Richard R. Gonzalez 24 Jun. 1987 25 p
(AD-A186226) Avail: NTIS HC A03/MF A01 CSCL 06J

Immersion in cold water brings about large changes in body temperature and metabolism that add to the complexity of modelling human thermoregulation. Three specific problems peculiar to such modelling are examined; they are: (1) finite-difference solution of the bioheat equation; (2) differences between predicted and measured initial conditions; and (3) prediction of convective heat loss. An optimization of the finite-difference solution of the simpler, but related, heat conduction problem is presented. A greater benefit is obtained by increasing the number of nodes rather than decreasing the integration time interval. A procedure is given for matching the predicted and measured initial values of the deep body temperature and the metabolic rate which allows a more accurate determination of set-point values for thermoregulation. To circumvent the acute sensitivity to the skin-water temperature difference using the conventional prediction of convective heat loss, use of a heat balance during steady-state of the skin temperature is outlined. GRA

N88-16330# Jyvaskyla Univ. (Finland). Dept. of Physics.
LATE RADIATION DAMAGE IN BONE, BONE MARROW AND BRAIN VASCULATURE, WITH PARTICULAR EMPHASIS UPON FRACTIONATION MODELS Ph.D. Thesis
Maunu Pitkaenen Apr. 1986 61 p
(DE87-753039; JYFL-RR-1/86) Avail: NTIS (US Sales Only) HC A04/MF A01

X-ray induced changes in rat and human bone and bone marrow vasculature and in rat brain vasculature were measured as a function of time after irradiation and absorbed dose. The absorbed dose in the organ varied from 5 to 25 Gy for fractionated irradiations. The number of fractions varied from 3 to 10 for the rats and from 12 to 25 for the human. Blood flow changes were measured using an 1-2-5I antipyrine or 8-6RbCl extraction technique. The red blood cell (RBC) volume was examined by 5-1Cr labelled red cells. Different fractionation models have been compared. Radiation induced reduction of bone and bone marrow blood flow were both time dose dependent. Reduced blood flow 3 months after irradiation would seem to be an important factor in the subsequent atrophy of bones. With a single dose of 10 Gy the bone marrow blood flow returned to the control level by 7 months after irradiation. In the irradiated bone the RBC volume was about the same as that in the control side but in bone marrow the reduction was from 32 to 59 percent. The dose levels predicted by the nominal standard dose (NSD) formula produced about the same damage to the rat femur seven months after irradiation when the extraction of 8-6Rb chloride and the dry weight were concerned as the end points. However, the results suggest that the NSB formula underestimates the late radiation damage in bone marrow when a small number of large fractions are used. In the irradiated brains of the rats, the blood flow was on average 20.4 percent higher compared to that in the control group. There was no significant difference in brain blood flow between different fractionation schemes. The value of 0.42 for the exponent of N corresponds to the average value for central nervous system tolerance in the literature. The model used may be sufficiently accurate for clinical work provided the treatment schemes used do not depart too radically from standard practice. DOE

N88-16331*# Essex Corp., Orlando, Fla.
PRELIMINARY EVALUATION OF A MICRO-BASED REPEATED MEASURES TESTING SYSTEM
Robert S. Kennedy, Robert L. Wilkes, and Norman E. Lane 1985 32 p
(Contract NAS9-17326)
(NASA-CR-172038; NAS 1.26:172038; EOTR-85-1) Avail: NTIS HC A03/MF A01 CSCL 06E

A need exists for an automated performance test system to study the effects of various treatments which are of interest to the aerospace medical community, i.e., the effects of drugs and environmental stress. The ethics and pragmatics of such assessment demand that repeated measures in small groups of subjects be the customary research paradigm. Test stability, reliability-efficiency and factor structure take on extreme significance; in a program of study by the U.S. Navy, 80 percent

of 150 tests failed to meet minimum metric requirements. The best is being programmed on a portable microprocessor and administered along with tests in their original formats in order to examine their metric properties in the computerized mode. Twenty subjects have been tested over four replications on a 6.0 minute computerized battery (six tests) and which compared with five paper and pencil marker tests. All tests achieved stability within the four test sessions, reliability-efficiencies were high (r greater than .707 for three minutes testing), and the computerized tests were largely comparable to the paper and pencil version from which they were derived. This computerized performance test system is portable, inexpensive and rugged. Author

N88-16332* National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 307)
Feb. 1988 72 p
(NASA-SP-7011(307); NAS 1.21:7011(307)) Avail: NTIS HC A05; NTIS standing order as PB88-9123000, $9.00 domestic, $18.00 foreign CSCL 06E

This bibliography lists 203 reports, articles, and other documents introduced into the NASA scientific and technical information system in January, 1988. Author

N88-16333# Army Research Inst. of Environmental Medicine, Natick, Mass.
OPERATION EVEREST 2: NUTRITION AND BODY COMPOSITION Final Report, Sep. - Nov. 1985
Madeleine S. Rose, Charles S. Houston, Charles S. Fulco, Geoffrey Coates, John R. Sutton (McMaster Univ., Hamilton, Ontario), and Allen Cymerman 21 Aug. 1987 34 p
(Contract DAMD17-85-C-5206)
(AD-A186449) Avail: NTIS HC A03/MF A01 CSCL 06J

Progressive body weight loss occurs during high mountain expeditions, but whether it is due to hypoxia, inadequate diet, malabsorption, or to multiple stresses of the harsh environment is unknown. To determine whether hypoxia alone causes such weight loss, six men, provided with a palatable adlibitum diet, were studied during progressive decompression to 240 Torr for 40 days in a hypobaric chamber where hypoxia was the major variable. Caloric intake decreased 42.3% from 3136 kcal to 1789 kcal. The percent carbohydrate in the diet decreased from 62.1% to 53.2%. All subjects lost weight averaging about 7.4 +/- 2.2 kg. Hydrostatic weighing indicated that 4 subjects lost 2.7% body fat whereas two gained 0.65%. Computerized tomographic scans showed that most of the weight loss was derived from lean body mass. Data indicated that prolonged exposure to increasing hypoxia is associated with reduction in carbohydrate preference and body weight despite access to ample varieties and quantities of food. This study suggested that hypobaric hypoxia rather than the combined stress of the mountain environment is sufficient cause for the reduction in food intake reported by mountain expeditions at high altitudes. GRA

N88-16334# Army Research Inst. of Environmental Medicine, Natick, Mass.
INFLUENCE OF SKELETAL MUSCLE GLYCOGEN ON PASSIVE REWARMING AFTER HYPOTHERMIA
P. D. Neufer, Andrew J. Young, Michael N. Sawka, and Stephen R. Muza Aug. 1987 23 p
(AD-A186451) Avail: NTIS HC A03/MF A01 CSCL 06O

Individuals performing work and athletes competing in cold conditions may experience, in addition to muscle glycogen depletion, mild to moderate hypothermia. It has been hypothesized that muscle glycogen may provide the substrate for shivering thermogenesis. To examine the influence of muscle glycogen on the thermal responses to passive rewarming subsequent to mild hypothermia, eight subjects completed two cold (18 C) water immersions followed by 75 min of passive rewarming (24 C air, resting in blanket). The experiments followed several days of different exercise/diet regimens eliciting either low or normal prewarming muscle glycogen levels. Cold water immersion was performed for 180 min or to a rectal temperature T sub re of less than 35.5 C. Rewarming increased T sub re similarly during both LMG and NMG. Independent of treatment, afterdrop responses were evident only in those individuals (body fat is less than 15 percent) whose body core cooled during immersion supporting the contention that afterdrop is a function of the kinetics of heat flow through a mass of tissue. Furthermore, these data indicate that low muscle glycogen levels do not impair rewarming time nor alter afterdrop responses during passive rewarming following mild to moderate hypothermia. GRA

N88-16335# Army Research Inst. of Environmental Medicine, Natick, Mass.
DETERMINATION OF THE EFFECT OF WALKING ON THE FORCED CONVECTIVE HEAT TRANSFER COEFFICIENT USING AN ARTICULATED MANNIKIN
S. K. Chang, E. Arens, and R. R. Gonzalez May 1987 20 p
(AD-A186452) Avail: NTIS HC A03/MF A01 CSCL 06J

This study addresses the effect of the walking motion on local convective heat transfer coefficient at various body sites, employing an articulated mannikin. The forced convective heat transfer coefficient (h sub c) is determined by the napthalene sublimation plate technique. Circular napthalene disks were affixed to various body segments of the articulated mannikin. The mannikin then simulated walking at four different gaits under constant temperature (30 C) and wind speed (0.4-0.7 m./sec depending on the body segment) in an environmental chamber. The amount of napthalene weight loss through sublimation was translated to h sub c using the Chilton-Colburn analogy between heat and mass transfer. The results showed that arm movement during walking, unexpectedly, diminished the effective local convective transfer coefficient. Increased gait actually resulted in a decrease in h sub c, as measured on the arms and legs. On the nonmoving body trunk, no significant difference in h sub c was observed with increased gait. When the mannikin was held stationary and the chamber wind speed increased, a corresponding increase in h sub c was observed. Thus during walking, motion of the swinging limbs, the pendulum or pumping effect, tends to decrease the forced convective heat transfer coefficient as observed locally on the limbs. For the walking gaits applied in this study, a 5-7 percent decrease in h sub c was observed. GRA

N88-16336# Army Research Inst. of Environmental Medicine, Natick, Mass.
THE USE OF HEART RATE IN THE PRESCRIPTION AND EVALUATION OF EXERCISE PROGRAMS
Reed W. Hoyt 17 May 1987 21 p
(AD-A186454) Avail: NTIS HC A03/MF A01 CSCL 06D

The direct measurement of maximal oxygen uptake (VO2max) during exercise to exhaustion provides a scientifically rigorous means of comparing the aerobic capacities of different individuals and of assessing the effects of endurance training on cardiorespiratory fitness. However, the complexity and expense of this approach has led to the development of simpler techniques designed to achieve the same ends. After a brief description of a maximal exercise test which can be used to compare the cardiorespiratory fitness of different individuals this paper will discuss in detail how to use the heart rate response to standardized exercise to monitor the effects of endurance training to the relative fitness of an individual. GRA

N88-16337# Army Research Inst. of Environmental Medicine, Natick, Mass.
OPERATION EVEREST 2: COMPARISON OF FOUR INSTRUMENTS FOR MEASURING BLOOD OXYGEN SATURATION
Vincent A. Forte, Jr., Mark K. Malconian, Paul B. Rock, Patricia M. Young, Laurie A. Trad, Bruce A. Ruscio, John R. Sutton, Charles S. Houston (Vermont Univ., Burlington.), and Allen Cymerman 15 Jun. 1987 25 p
(Contract DAMD17-85-C-5206)
(AD-A186456) Avail: NTIS HC A03/MF A01 CSCL 06L

The accuracy of four devices for measuring arterial and venous saturation (SO2) was evaluated during a study of hypobaric hypoxia conducted with eight male subjects exposed progressively to simulated altitudes from sea level to 29,000 ft. Saturation was measured with the Lex-O2-Con-K (galvanic cell; oxygen content (O2 Con)/modified Siggard-Anderson Equation; Lex), IL-282 Co-Oximeter (spectrophotometric; Co-Ox), and the Radiometer ABL-300 [PO2/Siggard-Anderson Equation; ABL-300). Non-invasive spectrophotometric measurements of SO2 were made with an HP 47201A Ear-Oximeter (Ear-Ox). Saturation was calculated from O2 Con. The Co-Ox, which correlates with the Van Slyke method over a wide physiological range was used as the reference method for measuring SO2. With the exception of the Ear-Ox, each instrument compared favorably with the Co-Ox over a broad range. In conclusion, the ABL-300 and the Lex are comparable in accuracy to the Co-Ox. GRA

N88-16338# Army Research Inst. of Environmental Medicine, Natick, Mass.

PORTABLE, AMBIENT AIR MICROCLIMATE COOLING IN SIMULATED DESERT AND TROPIC CONDITIONS

Stephen R. Muza, Nancy A. Pimental, Henry M. Cosimini, and Michael N. Sawka Apr. 1987 24 p

(AD-A186457) Avail: NTIS HC A03/MF A01 CSCL 06L

The feasibility of providing ambient air during exercise and conditioned air during rest on reducing physiological strain and optimizing tolerance time was examined. Six male soldiers attempted 250-min exposures in hot/dry and hot/wet environments. Subjects wore chemical protective clothing over the combat vehicle crewman uniform and an air-cooled vest. They alternated between 50 min of treadmill walking and 50 min of rest. During the walks, a backpack mounted blower provided a total of 10 or 18 cfm of air to the vest and face; while subjects received 18 cfm of conditioned air from an umbilical during rest. In the hot/wet environment, tolerance time was extended compared to a predicted tolerance time assuming no microclimate cooling. We concluded that the ambient air backpack reduced physiological strain and improved tolerance time of combat vehicle crewman during exercise in the heat. In addition, since the physiological and tolerance time responses with the 10 cfm airflow were midway between the control and 18 cfm airflow results, further tests may find an intermediate airflow rate which significantly improves performance while minimizing the backpack blower size. GRA

N88-16339# Army Research Inst. of Environmental Medicine, Natick, Mass.

RAPID HYPOTHERMIA SUBSEQUENT TO ORAL NICOTINIC ACID AND IMMERSION IN WARM (30C) WATER

Roger W. Hubbard, Lawrence E. Armstrong, and Andrew J. Young Mar. 1987 6 p

(AD-A186458) Avail: NTIS HC A02/MF A01 CSCL 06O

The purpose to this letter to the Editor is to describe the results of pilot studies conducted to evaluate body cooling by water immersion, with and without nicotinic acid. Nicotinic acid pretreatments resulted in greater body cooling than control trials. However, cooling rates were less than can be achieved with evaporative cooling techniques. The striking feature of the nicotinic acid trials involved the magnitude of body cooling achieved in relatively temperate water (30 C). GRA

N88-16340# Army Research Inst. of Environmental Medicine, Natick, Mass.

RESPIRATORY AND CARDIOVASCULAR RESPONSES TO COLD STRESS FOLLOWING REPEATED COLD WATER IMMERSION

S. B. Muza, A. J. Young, M. N. Sawka, J. E. Bogart, and K. B. Pandolf Jul. 1987 32 p

(AD-A186460) Avail: NTIS HC A03/MF A01 CSCL 06J

The effects of cold acclimation (CA) on the cardiorespiratory responses to cold air and water stress tests (CST) were studied in seven males before and after a CA program of daily 90 min cold water (18 C) immersions repeated five times a week for five consecutive weeks. The CST consisted of a 90 min resting exposure to cold air or water during which rectal temperature (T sub re), oxygen consumption (VO2), carbon dioxide production (VCO2), minute ventilation (V sub E), heart rate (HR), cardiac output (Q) and blood pressure (BP) were periodically measured. In cold air following CA, the VO2 at 10 minutes was lower post than pre CA, however, no differences were found in cold water. The (V sub E) increased during CST as a function of VCO2. The CA did not affect the (V sub E)-VCO2 relationship or the pattern of breathing during CST in cold air or water. The CA had no effect on Q or (a-V) O2 difference, which both increased during the first 45 min of CST, then remained stable. BP increased significantly during the first cold water exposure, but not during the last cold water immersion. These data indicate the CA attenuated the onset of metabolic heat production during CST in air but did not alter its ultimate magnitude or the relationships between the cardiorespiratory variables and metabolic requirements. Also the thermoregulatory adjustments associated with CA altered the control of blood pressure during acute cold stress. GRA

N88-16341# Army Research Inst. of Environmental Medicine, Natick, Mass.

TEMPERATURE REGULATION AT REST AND EXERCISE DURING THE HUMAN MENSTRUAL CYCLE

Margaret A. Kolka, Lou A. Stephenson, and Richard R. Gonzalez Jul. 1987 30 p

(AD-A186461) Avail: NTIS HC A03/MF A01 CSCL 06J

Thermoregulatory responses were studied in eight women during three separate experimental protocols in both the follicular (F) and luteal (L) phases of the menstrual cycle. Continuous measurements of esophageal temperature (T sub es), mean skin temperature (T sub sk), metabolism, and forearm sweating (m sub s) were made during all experiments. Study 1 evaluated 35 minutes of seated cycle exercise. Study 2 involved both passive heat exposure and seated cycle exercise to elicit a 0.8 C increase in T sub es. Study 3 evaluated high intensity exercise. The normal L increase in resting T sub es occurred in all eight subjects. T sub sk was higher during L than F in all experiments. During exercise, the T sub es threshold for sweating was higher in L, with no change in the slope of m sub s to T sub es between menstrual cycle phases. This rightward shift in T sub es averaged 0.53 C for all conditions studied. Temperature regulation in healthy women varies with menstrual cycle phase as the onset of sweating occurs at an elevated T sub es threshold in the luteal phase when resting core temperature is elevated. GRA

N88-16265# Karolinska Inst., Stockholm (Sweden). Dept. of Baromedicine.

THE ESA ANTHRORACK PROJECT: INTEGRATED RESEARCH IN HUMAN PHYSIOLOGY

D. Linnarsson *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 387-389 (For primary document see N88-16201 08-46)

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N88-16324# Joint Publications Research Service, Arlington, Va.

GENERAL BIOLOGICAL CHARACTER OF ADAPTIVE CAPACITY OF MAMMALIAN METABOLISM IN RESPONSE TO DIVERSE AND EXTREME ENVIRONMENTAL FACTORS Abstract Only

B. M. Grayevskaya and N. N. Zolotareva *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences 5 Dec. 1986 p 81 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 289, no. 1, Jul. 1986 p 250-252 (For primary document see N88-16318 08-51)

Copyright Avail: NTIS HC A06/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N88-16342# Naval Health Research Center, San Diego, Calif.
ANTARCTICA AS A MODEL FOR THE HUMAN EXPLORATION OF MARS Final Report
Lawrence A. Palinkas 19 Jul. 1987 23 p
(AD-A185835; NAVHLTHRSCHC-87-16) Avail: NTIS HC A03/MF A01 CSCL 05H

Among the many issues to be addressed in planning for the eventual human exploration of Mars are the processes of social adaptation and psychological adjustment to prolonged isolation in an extreme environment. An understanding of these two interrelated processes is critical from the standpoint of personnel selection, crew organization, and task performance. The human experience of exploration and research in Antarctica can contribute much to this understanding. This paper provides a brief historical overview of the experience of social adaptation and psychological adjustment of Antarctic expeditions. Factors which currently influence these processes in the Antarctic, including social organization, Antarctic culture social and psychological resources used for coping with stress, and environmental resources and constraints, are examined. This paper also describes the effect of these processes on the health and performance of Antarctic winter-over personnel. The relevance of the Antarctic experience to planning for extended missions on Mars is discussed. GRA

N88-16343# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
TARGET SIZE AND LUMINANCE EFFECTS ON ACCOMMODATION AND VERGENCE M.S. Thesis
Leon Norse McLin, Jr. 1987 187 p
(AD-A185861; AFIT/CI/NR-87-88T) Avail: NTIS HC A09/MF A01 CSCL 06D

This investigation, using Schor's (Schor and Kotulak 1986) dual interaction model of accommodation and vergence sought to determine how three different stimuli, namely dynamic size changes, voluntary effort, and luminance changes might influence accommodation and vergence. The mutual independence of the accommodative convergence and convergence accommodation crosslinks are primary features of this model. The AC/A and CA/C ratios were used as a tool to determine whether changing size or voluntary efforts was primarily influencing accommodation or vergence. Another main feature of this model is the separate tonic adapters for vergence and accommodation that occur after the crosslinks. Schor et al., (1986) found that tonic aftereffects of accommodation are masked in darkness. We investigated the effect of different luminance levels on these tonic aftereffects. In chapter 2, changing size was found to produce changes in both accommodation and vergence and these changes occur in a ratio like the AC/A ratio rather than the CA/C ratio. In chapter 3, voluntary effort is shown to produce changes in accommodation and vergence in proportions of an AC/A ratio rather than a CA/C ratio. In chapter 4, accommodative aftereffects were shown to be masked in scotopic luminance levels and partially masked at mesopic luminance levels when the accommodative loop was opened with a pinhole. GRA

N88-16344# Research Inst. of National Defence, Stockholm (Sweden).
OVERLEARNING AND POSITIVE THINKING ALLEVIATE NEGATIVE EFFECTS OF STRESS ON PERFORMANCE
Gerry Larsson Aug. 1987 11 p In SWEDISH; ENGLISH summary
(FOA-C-50051-5.3; ISSN-0347-7665; ETN-88-91409) Avail: NTIS HC A03/MF A01

The impact of different stressors on performance was studied. A company of army conscripts performed a test on a training simulator in calm conditions and in noisy conditions when they were exhausted. This effect was alleviated by a high amount of overlearning. Conscripts who appraised the situation as challenging used much self-talk of positive thinking character and performed well. Those who appraised the situation as threatening used much self-talk of negative thinking character and performed poorly. ESA

N88-16345# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A COMPARISON OF THE EFFECTS OF GROUP DYNAMICS ON INDIVIDUALS ASSIGNED TO INTEGRAL AND NON-INTEGRAL AIRCREWS M.S. Thesis
Paul M. Sowada Sep. 1987 104 p
(AD-A186467; AFIT/GSM/LSR/87S-32) Avail: NTIS HC A06/MF A01 CSCL 05H

This study compared and contrasted the effects of group dynamics using Strategic Air Command KC-135 officer aircrew members who operate under an integral crew concept and Military Airlift Command officer aircrew members who operate under a non-integral crew concept. The study compared level of group cohesiveness and intragroup communications between the two types of crew structures. It also examined the degree of confidence crewmembers had in the people with whom they flew, attitudes regarding flying safety norms, and the type of crew structure preferred in a combat environment. Finally, this study sought to determine if crewmembers perceived that navigators had a greater opportunity to assume a leadership role in the crew with whom they flew if performing their duties under an integral crew structure. GRA

N88-16346# Gulf and Western Applied Science Labs., Waltham, Mass.
RESEARCH ON VISUAL INFORMATION PROCESSING WITH SPECIAL REFERENCE TO OCULOMOTOR BEHAVIOR IN THE AREAS OF EXPLORATION, RECOGNITION AND SEARCH Final Technical Report, Mar. 1986 - Mar. 1987
Leonard F. Scinto Mar. 1987 37 p
(Contract DAAA15-86-C-0025)
(AD-A186598) Avail: NTIS HC A03/MF A01 CSCL 06D

The research sought to understand a certain fundamental aspect of visual information processing in the areas of recognition, exploration and search behavior. Progress was made in the following areas. (1) Laboratory Reconfiguration. During the six months of this contract ASL undertook to upgrade and augment the eye movement recording equipment at HEL. One major effort was devoted to writing a data acquisition program to record and analyze pupil diameter data. (2) Data Collection & Analysis. An entirely new hardware and software data acquisition environment had to be designed and built and a new I/O configuration designed for the PDP 11 computer. GRA

N88-16347# Naval Health Research Center, San Diego, Calif.
GROUP ADAPTATION AND INDIVIDUAL ADJUSTMENT IN ANTARCTICA: A SUMMARY OF RECENT RESEARCH Final Report
L. A. Palinkas 13 Aug. 1987 39 p
(AD-A186605; NHRC-87-24) Avail: NTIS HC A03/MF A01 CSCL 05H

The relationship between group adaptation and individual adjustment has been the focus of recent research on the long-term effects of prolonged isolation in the Antarctic. A series of studies conducted at the Naval Health Research Center examined the health and service records of enlisted Navy personnel who applied to the Operation Deep Freeze Program between 1963 and 1974. The objective of these studies was to determine if follow-up incidence rates and performance criteria were significantly different between a group of winter-over personnel and a control group of enlisted personnel who were screened and qualified for winter-over duty but assigned elsewhere. Results indicated that the overall incidence rate for the winter-over group was significantly lower than the rate for the control group. An increase in total disease incidence was observed among the winter-over group within a year of their return from the Antarctic, but this increase failed to attain statistical significance relative to the rate of the control group. In addition, individuals with high needs for achievement

and control over others were found to be at reduced risk for long-term disease incidence. These results are examined in light of personality traits which facilitate adjustment to stressful life events and the sociocultural systems of Antarctic stations which support and promote values enabling personnel to adapt to prolonged isolation. GRA

N88-16348# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Psychology.
CIRRUS: AN AUTOMATED PROTOCOL ANALYSIS TOOL Technical Report, 15 Jun. 1986 - 31 Oct. 1987
Kurt VanLehn and Steve Garlick 15 Apr. 1987 24 p Presented at the 4th International Workshop on Machine Learning, Los Altos, Calif., 1987
(Contracts N00014-86-K-0349; N00014-85-C-0688; Proj. RR0-4206)
(AD-A186646; PCG-6) Avail: NTIS HC A03/MF A01 CSCL 05I

Cirrus is a tool for protocol analysis. Given an encoded protocol of a subject solving problems, it constructs a modal that will produce the same protocol as the subject when it is applied to the same problems. In order to parameterize Cirrus for a task domain, the user must supply it with a problem space: a vocabulary of attributes and values for describing spaces, a set of primitive operators, and set of macro operators. Cirrus model of the subject is a hierarchical plan that is designed to be executed by an agenda based plan follower. Cirrus main components are a plan recognizer and a condition inducer. The condition inducer is based on Quinlan's ID3. Cirrus has potential applications not only in psychology but also as the student modelling component in an intelligent tutoring system. GRA

N88-16349# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Psychology.
DERIVING DESCRIPTIONS OF THE MIND Technical Report, 15 Jun. 1986 - 31 Oct. 1987
Steve Garlick and Kurt VanLehn 7 Jul. 1987 61 p
(Contract N00014-86-K-0349)
(AD-A186647; PCG-7) Avail: NTIS HC A04/MF A01 CSCL 05I

Cirrus is a tool for protocol analysis. Given an encoded protocol of a subject solving problems, it constructs a model that will produce the same protocol as the subject when it is applied to the same problems. In order to parameterize Cirrus for a task domain, the user must supply it with a problem space: a vocabulary of attributes and values for describing spaces, a set of primitive operators, and a set of macro-operators. Cirrus' model of the subject is a hierarchical plan that is designed to be executed by an agenda-based plan follower. In this paper, the philosophical and mathematical foundations of Cirrus are explored. GRA

N88-16350# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Psychology.
CHANGING THE LAYERS OF MIND Technical Report, 15 Jun. 1986 - 31 Oct. 1987
Kurt VanLehn 2 Jul. 1987 19 p
(Contracts N00014-86-K-0349; N00014-86-K-0678)
(AD-A186648; PCG-12) Avail: NTIS HC A03/MF A01 CSCL 05H

It is common in cognitive science to assume that the mind is composed of layers of programmable machines. The machine of the top layer runs the end user program which, roughly speaking, performs the task at hand. Every other machine runs a program that implements the memories and primitive processes of the machine above it in the stack of layers. The bottom machine is actual neuronal hardware. A natural part of the layering principle in computer systems design is that the layers can be changed. In particular, any layer, except the hardware layer, can be replaced without changing the others. This essay examines the physiological implications of the hypothesis that layers can be changed. GRA

N88-16351*# Essex Corp., Orlando, Fla.
STABILITY, RELIABILITY AND CROSS-MODE CORRELATIONS OF TESTS IN A RECOMMENDED 8-MINUTE PERFORMANCE ASSESSMENT BATTERY
R. L. Wilkes, R. S. Kennedy, W. P. Dunlap, and N. E. Lane Apr. 1986 53 p
(Contract NAS9-17326)
(NASA-CR-172039; NAS 1.26:172039; EOTR-86-4) Avail: NTIS HC A04/MF A01 CSCL 05I

A need exists for an automated performance test system to study drugs, agents, treatments, and stresses of interest to the aviation, space, and environmental medical community. The purpose of this present study is to evaluate tests for inclusion in the NASA-sponsored Automated Performance Test System (APTS). Twenty-one subjects were tested over 10 replications with tests previously identified as good candidates for repeated-measure research. The tests were concurrently administered in paper-and-pencil and microcomputer modes. Performance scores for the two modes were compared. Data from trials 1 to 10 were examined for indications of test stability and reliability. Nine of the ten APT system tests achieved stability. Reliabilities were generally high. Cross-correlation of microbased tests with traditional paper-and-pencil versions revealed similarity of content within tests in the different modes, and implied at least three cognition and two motor factors. This protable, inexpensive, rugged, computerized battery of tests is recommended for use in repeated-measures studies of environmental and drug effects on performance. Identification of other tests compatible with microcomputer testing and potentially capable of tapping previously unidentified factors is recommended. Documentation of APTS sensitivity to environmental agents is available for more than a dozen facilities and is reported briefly. Continuation of such validation remains critical in establishing the efficacy of APTS tests. Author

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

For related information see also *16 Space Transportation.*

N88-16352# Naval Underwater Systems Center, Newport, R.I.
PROCEEDINGS OF THE DOD WORKLOAD ASSESSMENT WORKSHOP ON WORKLOAD ASSESSMENT TECHNIQUES AND TOOLS HELD IN DAYTON, OHIO ON 27-28 SEPTEMBER 1986
Heidi M. Fiedler 15 Sep. 1987 352 p Workshop held in Dayton, Ohio, 27-28 Sep. 1986
(AD-A185650; NUSC-TD-6608) Avail: NTIS HC A16/MF A01 CSCL 05H

A major function of human factors engineering throughout the system development process is to ensure that system demands do not exceed the information processing capabilities of the human operator. Processing overload is a central factor leading to breakdowns in operator performance and to the compromises in system safety and effectiveness that can result from such decrements. Mental work is the term which refers to that portion of an operators limited processing capacity which is actually required to perform a particular task or system function. The principal objective of workload assessment is to specify the amount of expanded processing capacity so that existing or potential overloads can be identified and decrements in operator performance avoided. Because of its critical role in the system development process, workload assessment has been the subject of considerable research over the past 10 years (e.g., Moray 1979). One product of these research efforts has been the development and application of a large number of individual workload assessment techniques. A recent comprehensive review (Wierwille and Williges, 1978) of the workload assessment literature, for example, identified 28 different techniques that had been used to derive measures of load. A substantial number of these empirical assessment techniques, can be classified as belonging to one of

three categories of workload measures: (1) subjective opinion procedures, (2) performance-based techniques, and (3) physiological techniques. GRA

N88-16353*# Life Systems, Inc., Cleveland, Ohio.
ELECTROCHEMICAL CARBON DIOXIDE CONCENTRATOR SUBSYSTEM DEVELOPMENT Final Report
E. P. Koszenski, D. B. Heppner, and C. T. Bunnell Mar. 1986 92 p
(Contract NAS2-11783)
(NASA-CR-177411; NAS 1.26:177411; TR-600-4) Avail: NTIS HC A05/MF A01 CSCL 05H

The most promising concept for a regenerative CO2 removal system for long duration manned space flight is the Electrochemical CO2 Concentrator (EDC), which allows for the continuous, efficient removal of CO2 from the spacecraft cabin. This study addresses the advancement of the EDC system by generating subsystem and ancillary component reliability data through extensive endurance testing and developing related hardware components such as electrochemical module lightweight end plates, electrochemical module improved isolation valves, an improved air/liquid heat exchanger and a triple redundant relative humidity sensor. Efforts included fabrication and testing the EDC with a Sabatier CO2 Reduction Reactor and generation of data necessary for integration of the EDC into a space station air revitalization system. The results verified the high level of performance, reliability and durability of the EDC subsystem and ancillary hardware, verified the high efficiency of the Sabatier CO2 Reduction Reactor, and increased the overall EDC technology engineering data base. The study concluded that the EDC system is approaching the hardware maturity levels required for space station deployment. Author

55 SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N88-16354*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
[RESEARCH IN PROGRESS AT THE INSTITUTE FOR COMPUTER APPLICATIONS IN SCIENCE AND ENGINEERING] Semiannual Report, 1 Apr. - 1 Oct. 1987
Dec. 1987 82 p
(Contract NAS1-18107)
(NASA-CR-181607; NAS 1.26:181607) Avail: NTIS HC A05/MF A01 CSCL 12A

This report summarizes research conducted at the Institute for Computer Applications in Science and Engineering in applied mathematics, numerical analysis, and computer science during the period April 1, 1987 through October 1, 1987. Author

60 COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing.

For components see *33 Electronics and Electrical Engineering.*

N88-16355*# Allen Associates, Newport News, Va.
HIGH-SPEED ASSEMBLY LANGUAGE (80386/80387) PROGRAMMING FOR LASER SPECTRA SCAN CONTROL AND DATA ACQUISITION PROVIDING IMPROVED RESOLUTION WATER VAPOR SPECTROSCOPY Final Report, 1 May 1986 - 31 Oct. 1987
Robert J. Allen Washington NASA Feb. 1988 35 p
(Contract NAS1-17919)
(NASA-CR-4117; NAS 1.26:4117; Rept-87-101) Avail: NTIS HC A03/MF A01 CSCL 09B

An assembly language program using the Intel 80386 CPU and 80387 math co-processor chips was written to increase the speed of data gathering and processing, and provide control of a scanning CW ring dye laser system. This laser system is used in high resolution (better than 0.001 cm-1) water vapor spectroscopy experiments. Laser beam power is sensed at the input and output of white cells and the output of a Fabry-Perot. The assembly language subroutine is called from Basic, acquires the data and performs various calculations at rates greater than 150 faster than could be performed by the higher level language. The width of output control pulses generated in assembly language are 3 to 4 microsecs as compared to 2 to 3.7 millisecs for those generated in Basic (about 500 to 1000 times faster). Included are a block diagram and brief description of the spectroscopy experiment, a flow diagram of the Basic and assembly language programs, listing of the programs, scope photographs of the computer generated 5-volt pulses used for control and timing analysis, and representative water spectrum curves obtained using these programs. Author

N88-16356# National Computing Centre Ltd., Manchester (England).
ADA (TRADE NAME) COMPILER VALIDATION SUMMARY REPORT. SYSTEMS DESIGNERS' PLC SD ADA-PLUS VAX/VMS x MC68020. VERSION 2B.00. HOST: VAX 8600. TARGET: MOTOROLA MC68020. COMPLETION OF ON-SITE TESTING Report, 1 Dec. 1986 - 1 Dec. 1987
1 Dec. 1986 50 p
(AD-A186571) Avail: NTIS HC A03/MF A01 CSCL 09B

This Validation Summary Report (VSR) summarizes the results and conclusions of validation testing performed on the SD Ada-Plus VAX/VMS x MC68020, 2B.00, using Version 1.8 of the Ada Compiler Validation Capability (ACVC). The SD Ada-Plus VAX/VMS x MC68020 is hosted on a VAX 8600 operating under VMS, 4.2. Programs processed by this compiler may be executed on a Motorola MC68020. On-site testing was performed 28 November 1986 through 1 December 1986 at Systems Designers plc, Camberley, under the direction of The National Computing Centre Ltd according to Ada Validation Organization policies and procedures. The AVF identified 2102 of the 2399 tests in ACVC Version 1.8 to be processed during on-site testing of the compiler. The 19 tests withdrawn at the time of validation testing, as well as the 278 executable tests that make use of floating-point precision exceeding that supported by the implementation were not processed. After the 2102 tests were processed, results for Class A, C, D, or E tests were examined for correct execution. Compilation listings for Class B tests were analyzed for correct diagnosis of syntax and semantic errors. Compilation and link results of Class L tests were analyzed for correct detection of errors. There were 184 of the processed tests determined to be inapplicable; the remaining 1918 tests were passed. GRA

N88-16373*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
INTEGRATION OF SYMBOLIC AND ALGORITHMIC HARDWARE AND SOFTWARE FOR THE AUTOMATION OF SPACE STATION SUBSYSTEMS Abstract Only
Hugh Gregg, Kathleen Healey, Edmund Hack, and Carla Wong (National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 81 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16375*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
KBS V AND V AS RELATED TO AUTOMATION OF SPACE STATION SUBSYSTEMS: RATIONALE FOR A KBS LIFECYCLE Abstract Only
K. Richardson and C. Wong *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 85 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16379*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A DISTRIBUTED ARCHITECTURE FOR INTELLIGENT MONITORING AND ANOMALY DIAGNOSIS OF THE HUBBLE SPACE TELESCOPE Abstract Only
Bryant G. Cruse *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 101-102 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16390*# Lockheed Missiles and Space Co., Menlo Park, Calif. Artificial Intelligence Center.
A MULTIPROCESSING ARCHITECTURE FOR REAL-TIME MONITORING
Thomas J. Laffey, James L. Schmidt, Jackson Y. Read, and Simon M. Kao *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 155-160 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16394*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACELAB DATA PROCESSING FACILITY (SLDPF) QUALITY ASSURANCE EXPERT SYSTEMS DEVELOPMENT
Lisa R. Basile and Angelita C. Kelly *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 181-185 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16399*# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
AN EXPERT SYSTEM TO ANALYZE HIGH FREQUENCY DEPENDENT DATA FOR THE SPACE SHUTTLE MAIN ENGINE TURBOPUMPS
Raul C. Garcia, Jr. *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 213-220 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16421*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AN INNOVATIVE WORKSTATION
James Villarreal *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 339-344 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, alogorithms, and specific applications, e.g., CAD/CAM.

N88-16357# Stanford Univ., Calif. Center for Reliable Computing.
SHORT PSEUDORANDOM TEST SEQUENCES
E. J. McCluskey and K. D. Wagner Feb. 1987 13 p
(Contract N00014-85-K-0600)
(AD-A185883; CRC-TR-87-6) Avail: NTIS HC A03/MF A01 CSCL 09B

This paper presents a probabilistic model for pseudorandom testing of combinational circuits and shows how the general model can be simplified for short test sequences. Pseudorandom test pattern generation uses an autonomous linear feedback shift register, ALFSR, as a source of test vectors. These test vectors can be, and are, used to test both combinational and sequential networks. Only combinational circuit testing is considered here. This discussion applies mainly to on-line testing in which the test patterns are generated during the test procedure rather than being stored copies of previously generated patterns. The difference is that all of the first L vectors in the sequence must be used rather than selected patterns. The patterns may be generated by circuits or by a program simulating an ALFSR. The major current issues for pseudorandom test pattern generation are: selecting the test length, determining the fault coverage, and identifying random-pattern resistant faults (faults that are hard-to-detect with random patterns). These could, in principle, all be accomplished by a full single-stuck fault simulation of the network to be tested. GRA

N88-16358# Naval Postgraduate School, Monterey, Calif.
A PROTOTYPE OF PILOT KNOWLEDGE EVALUATION BY AN INTELLIGENT CAI (COMPUTER-AIDED INSTRUCTION) SYSTEM USING A BAYESIAN DIAGNOSTIC MODEL M.S. Thesis
Yodchai Rugsumruad Jun. 1987 77 p
(AD-A186080) Avail: NTIS HC A05/MF A01 CSCL 12A

This thesis describes the Testing system, a Computer-Aided Instruction system which monitors the progress of a student and automatically adjusts the lesson to suit his/her understanding of the material being presented. Each lesson is divided into three segments. The first segment consists of questions critical to the basic understanding of the lesson, the second questions complementary to the lesson, and the third question supplementary. After the first segment, the student's performance is evaluated and a decision is made whether or not he/she should continue to the complementary segment of the lesson or go on to the next lesson. Similarly, in the second segment, a decision whether to continue to the supplementary segment or to the next lesson is made. Thus, a proficient student can progress through the material quickly, a slow learner slowly. The questions are grouped into types, and each of them is ranked as an easy or difficult concept to provide more precise guidance for the student's improvement. An example lesson is provided as an illustration. GRA

N88-16359# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
ASSESSMENT OF VAS-DERIVED PRODUCTS CREATED BY A SIMULTANEOUS ALGORITHM ON A CONVECTIVELY ACTIVE DAY M.S. Thesis
Mark J. Andrews 1987 120 p
(AD-A186158; AFIT/CI/NR-87-104T) Avail: NTIS HC A06/MF A01 CSCL 09B

GOES-VAS satellite retrievals created by a new 'simultaneous' algorithm are examined. The primary goals are to determine the spatial and temporal characteristics of the data, as well as the

magnitudes of mean and RMS errors. Several integrated and non-integrated stability parameters are examined to assess VAS's capability for providing useful information in convective storms forecasting. The improved moisture information has a positive impact on various stability indices. A VAS-derived Lifted Index appears to be a promising convection forecast tool. Many small scale features in satellite imagery were related to the Lifted Index analyses. Also, the VAS-derived values provided information that could not be obtained from conventional surface data. The K Index and Total Totals Index also provided forecast data; however, their resolution did not appear as good as those of the Lifted Index. Integrated values of positive and negative energies were calculated, as well as the heating energy required to raise the surface temperature to its convective value. The positive buoyant energy analyses were similar to the Lifted Index fields, while the negative energy patterns appeared to locate the lid to convective activity, thereby providing a forecaster with an additional prediction tool. GRA

N88-16360*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THIRD CONFERENCE ON ARTIFICIAL INTELLIGENCE FOR SPACE APPLICATIONS, PART 1

Judith S. Denton, comp., Michael S. Freeman, comp., and Mary Vereen, comp. Nov. 1987 421 p Conference held in Huntsville, Ala., 2-3 Nov. 1987; sponsored by NASA, Marshall Space Flight Center, Huntsville, Ala. and Alabama Univ., Huntsville

(NASA-CP-2492; M-575-Pt-1; NAS 1.55:2492) Avail: NTIS HC A18/MF A01 CSCL 09B

The application of artificial intelligence to spacecraft and aerospace systems is discussed. Expert systems, robotics, space station automation, fault diagnostics, parallel processing, knowledge representation, scheduling, man-machine interfaces and neural nets are among the topics discussed. For individual titles, see N88-16361 through N88-16443.

N88-16361*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

VERIFICATION ISSUES FOR RULE-BASED EXPERT SYSTEMS

Chris Culbert, Gary Riley, and Robert T. Savely *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 (date) 1-7 (SEE N88-16360 08-61) Nov. 1987 (For primary document see N88-16360 08-61)

Avail: NTIS HC A18/MF A01 CSCL 09B

Verification and validation of expert systems is very important for the future success of this technology. Software will never be used in non-trivial applications unless the program developers can assure both users and managers that the software is reliable and generally free from error. Therefore, verification and validation of expert systems must be done. The primary hindrance to effective verification and validation is the use of methodologies which do not produce testable requirements. An extension of the flight technique panels used in previous NASA programs should provide both documented requirements and very high levels of verification for expert systems. Author

N88-16362*# McDonnell-Douglas Corp., St. Louis, Mo. Research Labs.

USING OUTPUT TO EVALUATE AND REFINE RULES IN RULE-BASED EXPERT SYSTEMS

D. C. St.Clair, W. E. Bond, and B. B. Flachsbart *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 9-13 (For primary document see N88-16360 08-61)

Avail: NTIS HC A18/MF A01 CSCL 09B

The techniques described provide an effective tool which knowledge engineers and domain experts can utilize to help in evaluating and refining rules. These techniques have been used successfully as learning mechanisms in a prototype adaptive diagnostic expert system and are applicable to other types of expert systems. The degree to which they constitute complete evaluation/refinement of an expert system depends on the thoroughness of their use. Author

N88-16363*# Ford Aerospace and Communications Corp., Sunnyvale, Calif.

TEMPORAL AND CONTEXTUAL KNOWLEDGE IN MODEL-BASED EXPERT SYSTEMS

Tihamer Toth-Fejel and Dennis Heher *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 15-19 (For primary document see N88-16360 08-61)

Avail: NTIS HC A18/MF A01 CSCL 09B

A basic paradigm that allows representation of physical systems with a focus on context and time is presented. Paragon provides the capability to quickly capture an expert's knowledge in a cognitively resonant manner. From that description, Paragon creates a simulation model in LISP, which when executed, verifies that the domain expert did not make any mistakes. The Achille's heel of rule-based systems has been the lack of a systematic methodology for testing, and Paragon's developers are certain that the model-based approach overcomes that problem. The reason this testing is now possible is that software, which is very difficult to test, has in essence been transformed into hardware. Author

N88-16364*# Vanderbilt Univ., Nashville, Tenn. Center for Intelligent Systems.

METHODOLOGY FOR TESTING AND VALIDATING KNOWLEDGE BASES **c63**

C. Krishnamurthy, S. Padalkar, J. Sztipanovits, and B. R. Purves (Boeing Aerospace Co., Huntsville, Ala.) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 21-32 (For primary document see N88-16360 08-61)

Avail: NTIS HC A18/MF A01 CSCL 09B

A test and validation toolset developed for artificial intelligence programs is described. The basic premises of this method are: (1) knowledge bases have a strongly declarative character and represent mostly structural information about different domains, (2) the conditions for integrity, consistency, and correctness can be transformed into structural properties of knowledge bases, and (3) structural information and structural properties can be uniformly represented by graphs and checked by graph algorithms. The interactive test and validation environment have been implemented on a SUN workstation. Author

N88-16365*# Honeywell, Inc., Clearwater, Fla. Space and Strategic Avionics Div.

CLIPS AS A KNOWLEDGE BASED LANGUAGE

James B. Harrington *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 33-40 (For primary document see N88-16360 08-61)

Avail: NTIS HC A18/MF A01 CSCL 09B

CLIPS is a language for writing expert systems applications on a personal or small computer. Here, the CLIPS programming language is described and compared to three other artificial intelligence (AI) languages (LISP, Prolog, and OPS5) with regard to the processing they provide for the implementation of a knowledge based system (KBS). A discussion is given on how CLIPS would be used in a control system. R.J.F.

N88-16366*# Cincinnati Univ., Ohio. Dept. of Electrical and Computing Engineering.

AN EASY-TO-USE DIAGNOSTIC SYSTEM DEVELOPMENT SHELL

L. C. Tsai, J. B. Ross (General Electric Co., Evendale, Ohio.), C. Y. Han, and W. G. Wee *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 41-45 (For primary document see N88-16360 08-61)

Avail: NTIS HC A18/MF A01 CSCL 09B

The Diagnostic System Development Shell (DSDS), an expert system development shell for diagnostic systems, is described. The major objective of building the DSDS is to create a very easy to use and friendly environment for knowledge engineers and

end-users. The DSDS is written in OPS5 and CommonLisp. It runs on a VAX/VMS system. A set of domain independent, generalized rules is built in the DSDS, so the users need not be concerned about building the rules. The facts are explicitly represented in a unified format. A powerful check facility which helps the user to check the errors in the created knowledge bases is provided. A judgement facility and other useful facilities are also available. A diagnostic system based on the DSDS system is question driven and can call or be called by other knowledge based systems written in OPS5 and CommonLisp. A prototype diagnostic system for diagnosing a Philips constant potential X-ray system has been built using the DSDS. Author

N88-16367*# McDonnell-Douglas Corp., St. Louis, Mo. Artificial Intelligence Group.
AN INFERENCE ENGINE FOR EMBEDDED DIAGNOSTIC SYSTEMS
Barry R. Fox and Larry T. Brewster (Missouri Univ., Rolla.) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 47-51 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

The implementation of an inference engine for embedded diagnostic systems is described. The system consists of two distinct parts. The first is an off-line compiler which accepts a propositional logical statement of the relationship between facts and conclusions and produces data structures required by the on-line inference engine. The second part consists of the inference engine and interface routines which accept assertions of fact and return the conclusions which necessarily follow. Given a set of assertions, it will generate exactly the conclusions which logically follow. At the same time, it will detect any inconsistencies which may propagate from an inconsistent set of assertions or a poorly formulated set of rules. The memory requirements are fixed and the worst case execution times are bounded at compile time. The data structures and inference algorithms are very simple and well understood. The data structures and algorithms are described in detail. The system has been implemented on Lisp, Pascal, and Modula-2. Author

N88-16368*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CLIPS: AN EXPERT SYSTEM TOOL FOR DELIVERY AND TRAINING
Gary Riley, Chris Culbert, Robert T. Savely, and Frank Lopez *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 53-57 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

The C Language Integrated Production System (CLIPS) is a forward chaining rule-based language. The requirements necessary for an expert system tool which is used for development, delivery, and training are examined. Because of its high portability, low cost, and ease of integration with external systems, CLIPS has great potential as an expert system tool for delivery and training. In addition, its representation flexibility, debugging aids, and performance, along with its other strengths, make it a viable alternative for expert system development. Author

N88-16369*# Alabama Univ., Huntsville. Research Center.
ISSUES ASSOCIATED WITH TELEROBOTIC SYSTEMS IN SPACE c63
Scott A. Hofacker and Bernard J. Schroer *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 59-64 Sponsored in part by Boeing Aerospace Co. and Alabama Research Inst. (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Research issues in using telerobotics in space are discussed. Included is a review of previous research in space telerobotics and the results of several telerobotics experiments. Author

N88-16370*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
TELEROBOTIC CONTROLLER DEVELOPMENT c63
W. S. Otaguro, L. O. Kesler (McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.), Ken Land, and Don Rhoades *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 65-71 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

To meet NASA's space station's needs and growth, a modular and generic approach to robotic control which provides near-term implementation with low development cost and capability for growth into more autonomous systems was developed. The method uses a vision based robotic controller and compliant hand integrated with the Remote Manipulator System arm on the Orbiter. A description of the hardware and its system integration is presented. Author

N88-16371*# Alabama Univ., Huntsville. Research Center.
SOFTWARE SIMULATION OF TIME DELAY IN TELEOPERATION c63
K. Wayne Goode *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 73-77 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Research done in the Space Robotics Laboratory at the University of Atlanta at Huntsville on the effects of time delay on teleoperation is discussed. The laboratory is configured around a Puma 562 robot with 6 degrees of freedom. A custom designed joystick controller with two joysticks, each with three degrees of freedom, is used to control the robot. These joysticks are connected to the robot controller through an analog to digital interface. Joystick calibration, a computer program called Joystick, and the VAL 2 robot control language are discussed. R.J.F.

N88-16372*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MTK: AN AI TOOL FOR MODEL-BASED REASONING Abstract Only c63
William K. Erickson and Mary R. Schwartz *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 79 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

A 1988 goal for the Systems Autonomy Demonstration Project Office of the NASA Ames Research Center is to apply model-based representation and reasoning techniques in a knowledge-based system that will provide monitoring, fault diagnosis, control and trend analysis of the space station Thermal Management System (TMS). A number of issues raised during the development of the first prototype system inspired the design and construction of a model-based reasoning tool called MTK, which was used in the building of the second prototype. These issues are outlined, along with examples from the thermal system to highlight the motivating factors behind them. An overview of the capabilities of MTK is given. Author

N88-16373*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
INTEGRATION OF SYMBOLIC AND ALGORITHMIC HARDWARE AND SOFTWARE FOR THE AUTOMATION OF SPACE STATION SUBSYSTEMS Abstract Only c60
Hugh Gregg, Kathleen Healey, Edmund Hack, and Carla Wong (National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 81 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Expert systems that require access to data bases, complex simulations and real time instrumentation have both symbolic as well as algorithmic computing needs. These needs could both be

met using a general computing workstation running both symbolic and algorithmic code, or separate, specialized computers networked together. The later approach was chosen to implement TEXSYS, the thermal expert system, developed to demonstrate the ability of an expert system to autonomously control the thermal control system of the space station. TEXSYS has been implemented on a Symbolics workstation, and will be linked to a microVAX computer that will control a thermal test bed. Integration options are explored and several possible solutions are presented. Author

N88-16374*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REQUIREMENTS AND OPTIONS FOR COMMUNICATIONS SERVICES IN SUPPORT OF THE SYSTEMS AUTONOMY DEMONSTRATION PROJECT Abstract Only c32
Richard M. Brown and Robert Yee *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 83 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 17B

A study of the requirements and options for interconnecting the development systems and demonstration test beds at NASA centers supporting the Systems Autonomy Demonstration Project (SADP) is presented. The communications requirements of SADP development and demonstration environments are described, potential communications protocols are examined, and expected communications error rates and system availability are described. Author

N88-16375*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
KBS V AND V AS RELATED TO AUTOMATION OF SPACE STATION SUBSYSTEMS: RATIONALE FOR A KBS LIFECYCLE Abstract Only c60
K. Richardson and C. Wong *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 85 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

The role of verification and validation (V and V) in software has been to support and strengthen the software lifecycle and to ensure that the resultant code meets the standards of the requirements document. Knowledge based systems (KBS) V and V should serve the same role, but the KBS lifecycle is ill-defined. Here, the rationale of the simple form of the KBS lifecycle is explained. Special KBS development requirements are accommodated where possible by modifications to the traditional software lifecycle. Research areas are suggested for those aspects which present new or unusual difficulties for V and V. Author

N88-16376*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MONITORING OF SPACE STATION LIFE SUPPORT SYSTEMS WITH MINIATURE MASS SPECTROMETRY AND ARTIFICIAL INTELLIGENCE Abstract Only c63
Richard A. Yost, Jodie V. Johnson (Florida State Univ., Gainesville.), and Carla M. Wong *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 87 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

The combination of quadrupole ion trap tandem mass spectroscopy with artificial intelligence is a promising approach for monitoring the performance of the life support systems in the space station. Such an analytical system can provide the selectivity, sensitivity, speed, small size, and decision making intelligence to detect, identify, and quantify trace toxic compounds which may accumulate in the space station habitat. Author

N88-16377*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HSTDEK: DEVELOPING A METHODOLOGY FOR CONSTRUCTION OF LARGE-SCALE, MULTI-USE KNOWLEDGE BASES c82
Michael S. Freeman *In its* Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 89-94 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 05B

The primary research objectives of the Hubble Space Telescope Design/Engineering Knowledgebase (HSTDEK) are to develop a methodology for constructing and maintaining large scale knowledge bases which can be used to support multiple applications. To insure the validity of its results, this research is being persued in the context of a real world system, the Hubble Space Telescope. The HSTDEK objectives are described in detail. The history and motivation of the project are briefly described. The technical challenges faced by the project are outlined. Author

N88-16378*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
KNOWLEDGE-BASED MONITORING OF THE POINTING CONTROL SYSTEM ON THE HUBBLE SPACE TELESCOPE c17
Larry L. Dunham, Thomas J. Laffey, Simon M. Kao, James L. Schmidt, and Jackson Y. Read *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 95-100 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09F

A knowledge-based system for the real time monitoring of telemetry data from the Pointing and Control System (PCS) of the Hubble Space Telescope (HST) that enables the retention of design expertise throughout the three decade project lifespan by means other than personnel and documentation is described. The system will monitor performance, vehicle status, success or failure of various maneuvers, and in some cases diagnose problems and recommend corrective actions using a knowledge base built using mission scenarios and the more than 4,500 telemetry monitors from the HST. Author

N88-16379*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A DISTRIBUTED ARCHITECTURE FOR INTELLIGENT MONITORING AND ANOMALY DIAGNOSIS OF THE HUBBLE SPACE TELESCOPE Abstract Only c60
Bryant G. Cruse *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 101-102 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Lockheed, the Hubble Space Telescope mission operations contractor, is currently engaged in a project to develop a distributed architecture of communicating expert systems to support vehicle operations. This architecture, called Telemetry Analysis for Lockheed Operated Spacecraft (TALOS), has potentially wide applicability to spacecraft operations. The architecture mirrors the organization of the human experts within an operations control center. The prototype analyzes telemetry from a history tape to determine the state of the vehicle with respect to on-board safemode events. The prototype is currently being expanded along two fronts. One consists of expert systems modules which perform deeper level diagnostics and which operate in an off-line mode. The other is a high speed front-end expert system which will monitor real time telemetry for anomalies and spacecraft status and send activation and initialization messages to the off-line modules when an anomaly is detected. Author

N88-16380*# Lockheed Missiles and Space Co., Menlo Park, Calif. Artificial Intelligence Center.

A KNOWLEDGE-BASED SYSTEM FOR MONITORING THE ELECTRICAL POWER SYSTEM OF THE HUBBLE SPACE TELESCOPE **c63**

Pat Eddy *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 103-107 (For primary document see N88-16360 08-61)

Avail: NTIS HC A18/MF A01 CSCL 09B

The design and the prototype for the expert system for the Hubble Space Telescope's electrical power system are discussed. This prototype demonstrated the capability to use real time data from a 32k telemetry stream and to perform operational health and safety status monitoring, detect trends such as battery degradation, and detect anomalies such as solar array failures. This prototype, along with the pointing control system and data management system expert systems, forms the initial Telemetry Analysis for Lockheed Operated Spacecraft (TALOS) capability. Author

N88-16381*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ARTIFICIAL INTELLIGENCE AND SPACE POWER SYSTEMS AUTOMATION **c63**

David J. Weeks *In its* Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 109-113 (For primary document see N88-16360 08-61)

Avail: NTIS HC A18/MF A01 CSCL 09B

Various applications of artificial intelligence to space electrical power systems are discussed. An overview is given of completed, on-going, and planned knowledge-based system activities. These applications include the Nickel-Cadmium Battery Expert System (NICBES) (the expert system interfaced with the Hubble Space Telescope electrical power system test bed); the early work with the Space Station Experiment Scheduler (SSES); the three expert systems under development in the space station advanced development effort in the core module power management and distribution system test bed; planned cooperation of expert systems in the Core Module Power Management and Distribution (CM/PMAD) system breadboard with expert systems for the space station at other research centers; and the intelligent data reduction expert system under development. Author

N88-16382*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

EMBEDDED EXPERT SYSTEM FOR SPACE SHUTTLE MAIN ENGINE MAINTENANCE **c63**

J. Pooley, W. Thompson, T. Homsley, W. Teoh (Sparta, Inc., Huntsville, Ala.), J. Jones, and P. Lewallen *In its* Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 115-119 (For primary document see N88-16360 08-61)

Avail: NTIS HC A18/MF A01 CSCL 09B

The SPARTA Embedded Expert System (SEES) is an intelligent health monitoring system that directs analysis by placing confidence factors on possible engine status and then recommends a course of action to an engineer or engine controller. The technique can prevent catastropic failures or costly rocket engine down time because of false alarms. Further, the SEES has potential as an on-board flight monitor for reusable rocket engine systems. The SEES methodology synergistically integrates vibration analysis, pattern recognition and communications theory techniques with an artificial intelligence technique - the Embedded Expert System (EES). Author

N88-16383*# Tennessee Univ. Space Inst., Tullahoma.

QUALITATIVE AND TEMPORAL REASONING IN ENGINE BEHAVIOR ANALYSIS Abstract Only **c63**

W. E. Dietz, M. E. Stamps, and M. Ali *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 121-122 (For primary document see N88-16360 08-61)

Avail: NTIS HC A18/MF A01 CSCL 09B

Numerical simulation models, engine experts, and experimental data are used to generate qualitative and temporal representations of abnormal engine behavior. Engine parameters monitored during operation are used to generate qualitative and temporal representations of actual engine behavior. Similarities between the representations of failure scenarios and the actual engine behavior are used to diagnose fault conditions which have already occurred, or are about to occur; to increase the surveillance by the monitoring system of relevant engine parameters; and to predict likely future engine behavior. Author

N88-16384*# General Electric Co., Philadelphia, Pa. Astro-Space Div.

EXPLORING HYPOTHESES IN ATTITUDE CONTROL FAULT DIAGNOSIS **c63**

Benjamin Bell *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 123-130 (For primary document see N88-16360 08-61)

Avail: NTIS HC A18/MF A01 CSCL 09B

A system which analyzes telemetry and evaluates hypotheses to explain any anomalies that are observed is described. Results achieved from a sample set of failure cases are presented, followed by a brief discussion of the benefits derived from this approach. Author

N88-16385*# Messerschmitt-Boelkow-Blohm/Entwicklungspring Nord, Bremen (West Germany). Space Systems Group.

EUREX D: AN EXPERT SYSTEM FOR FAILURE DIAGNOSIS AND RECOVERY IN THE TCS OF THE EUROPEAN RETRIEVABLE CARRIER EURECA **c63**

A. Kellner, W. Belau, and N. Schielow *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 131-135 (For primary document see N88-16360 08-61)

Avail: NTIS HC A18/MF A01 CSCL 09B

An expert system for diagnosis and recovery of failures in the Freon cooling loop of the European retrievable experiment carrier EURECA is described. The system demonstrates the feasibility of a functional scope of expert diagnostic systems which appears to be essential for practical applications of such systems in space technology. The scope includes early warning and treatment of incomplete information, fault tolerance, identification of failure superpositions, intelligent reaction to unforeseen events, and detailed status display for optimal recovery action. Author

N88-16386*# Alabama Univ., Huntsville. Research Center.

TASK PATH PLANNING, SCHEDULING AND LEARNING FOR FREE-RANGING ROBOT SYSTEMS **c63**

G. Steve Wakefield *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 137-141 (For primary document see N88-16360 08-61)

Avail: NTIS HC A18/MF A01 CSCL 09B

The development of robotics applications for space operations is often restricted by the limited movement available to guided robots. Free ranging robots can offer greater flexibility than physically guided robots in these applications. Presented here is an object oriented approach to path planning and task scheduling for free-ranging robots that allows the dynamic determination of paths based on the current environment. The system also provides task learning for repetitive jobs. This approach provides a basis for the design of free-ranging robot systems which are adaptable to various environments and tasks. Author

N88-16387*# Vanderbilt Univ., Nashville, Tenn. Center for Intelligent Systems.

DEVELOPMENT OF A TASK-LEVEL ROBOT PROGRAMMING AND SIMULATION SYSTEM **c63**

H. Liu, K. Kawamura, S. Narayanan, G. Zhang, H. Franke, M. Ozkan, and H. Arima (Tokico Ltd., Kawasaki, Japan) *In* NASA.

Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 143-149 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

An ongoing project in developing a Task-Level Robot Programming and Simulation System (TARPS) is discussed. The objective of this approach is to design a generic TARPS that can be used in a variety of applications. Many robotic applications require off-line programming, and a TARPS is very useful in such applications. Task level programming is object centered in that the user specifies tasks to be performed instead of robot paths. Graphics simulation provides greater flexibility and also avoids costly machine setup and possible damage. A TARPS has three major modules: world model, task planner and task simulator. The system architecture, design issues and some preliminary results are given. Author

N88-16388*# Alabama Univ., Huntsville. Center for Applied Optics.
GOAL DRIVEN KINEMATIC SIMULATION OF FLEXIBLE ARM ROBOT FOR SPACE STATION MISSIONS Abstract Only c63
P. Janssen and A. Choudry *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 151 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Flexible arms offer a great degree of flexibility in maneuvering in the space environment. The problem of transporting an astronaut for extra-vehicular activity using a space station based flexible arm robot was studied. Inverse kinematic solutions of the multilink structure were developed. The technique is goal driven and can support decision making for configuration selection as required for stability and obstacle avoidance. Details of this technique and results are given. Author

N88-16389*# Technische Hogeschool, Delft (Netherlands). Faculty of Applied Physics.
HEURISTIC SEARCH IN ROBOT CONFIGURATION SPACE USING VARIABLE METRIC Abstract Only c63
Ben J. H. Verwer *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 (date) 153-154 (SEE N88-16360 08-61) Nov. 1987 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

A method to generate obstacle free trajectories for both mobile robots and linked robots is proposed. The approach generates the shortest paths in a configuration space. The metric in the configuration space can be adjusted to obtain a tradeoff between safety and velocity by imposing extra costs on paths near obstacles. Author

N88-16390*# Lockheed Missiles and Space Co., Menlo Park, Calif. Artificial Intelligence Center.
A MULTIPROCESSING ARCHITECTURE FOR REAL-TIME MONITORING c60
Thomas J. Laffey, James L. Schmidt, Jackson Y. Read, and Simon M. Kao *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 155-160 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

A multiprocessing architecture for performing real time monitoring and analysis using knowledge-based problem solving techniques is discussed. To handle asynchronous inputs and perform in real time, the system consists of three or more separate processes which run concurrently on one or more processors and communicate via a message passing scheme. The Data Management Process gathers, compresses, scales and sends the incoming telemetry data to other tasks. The Inference Process consists of a proprietary high performance inference engine that runs at 1000 rules per second using telemetry data to perform real time analysis on the state and health of the Space Telescope. The multiprocessing architecture has been interfaced to a simulator and is able to process the incoming telemetry in real time. Author

N88-16391*# Alabama Univ., Huntsville. Cognitive Systems Lab.
EXPERT SYSTEMS RELATIONS IN SPACE APPLICATIONS c66
Michael Brady *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 161-164 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

The problem of expert systems relations as they pertain to space applications is discussed. First, these systems are categorized and the relationships between them are analyzed. Then, the expert systems cooperation paradigm is proposed. This paradigm addresses various types of communication and coordination issues in an attempt to create a general model applicable in a number of situations. Author

N88-16392*# Louisiana State Univ., Baton Rouge. Dept. of Computer Science.
PROBLEM SOLVING AS INTELLIGENT RETRIEVAL FROM DISTRIBUTED KNOWLEDGE SOURCES c63
Zhengxin Chen *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 165-169 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Distributed computing in intelligent systems is investigated from a different perspective. From the viewpoint that problem solving can be viewed as intelligent knowledge retrieval, the use of distributed knowledge sources in intelligent systems is proposed. Author

N88-16393*# TRW Defense and Space Systems Group, Huntsville, Ala.
APPLICATION OF PARALLEL DISTRIBUTED PROCESSING TO SPACE BASED SYSTEMS c62
J. R. MacDonald and H. L. Heffelfinger *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 171-180 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

The concept of using Parallel Distributed Processing (PDP) to enhance automated experiment monitoring and control is explored. Recent very large scale integration (VLSI) advances have made such applications an achievable goal. The PDP machine has demonstrated the ability to automatically organize stored information, handle unfamiliar and contradictory input data and perform the actions necessary. The PDP machine has demonstrated that it can perform inference and knowledge operations with greater speed and flexibility and at lower cost than traditional architectures. In applications where the rule set governing an expert system's decisions is difficult to formulate, PDP can be used to extract rules by associating the information an expert receives with the actions taken. Author

N88-16394*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACELAB DATA PROCESSING FACILITY (SLDPF) QUALITY ASSURANCE EXPERT SYSTEMS DEVELOPMENT c60
Lisa R. Basile and Angelita C. Kelly *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 181-185 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

The Spacelab Data Processing Facility (SLDPF) is an integral part of the Space Shuttle data network for missions that involve attached scientific payloads. Expert system prototypes were developed to aid in the performance of the quality assurance function of the Spacelab and/or Attached Shuttle Payloads processed telemetry data. The Spacelab Input Processing System

(SIPS) and the Spacelab Output Processing System (SOPS), two expert systems, were developed to determine their feasibility and potential in the quality assurance of processed telemetry data. The capabilities and performance of these systems are discussed. Author

N88-16395*# Boeing Co., Huntsville, Ala. AI Center.
FMEASSIST: A KNOWLEDGE-BASED APPROACH TO FAILURE MODES AND EFFECTS ANALYSIS
James R. Carnes and Dannie E. Cutts *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 187-191 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

A Failure Modes and Effects Analysis workstation (FMESassist) was designed for use during the development of the space station. It assists engineers in the complex task of tracking failures and their effects on the system. Engineers experience increased productivity through reduced clerical loads, reduced data inconsistency, and significantly reduced analysis time. System developments benefit from a more thorough analysis than was available using previous methods. Author

N88-16396*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ESSAA: EMBEDDED SYSTEM SAFETY ANALYSIS ASSISTANT Abstract Only
Peter Wallace, Joseph Holzer, Sergio Guarro, and Larry Hyatt *In its* Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 193-194 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

The Embedded System Safety Analysis Assistant (ESSAA) is a knowledge-based tool that can assist in identifying disaster scenarios. Imbedded software issues hazardous control commands to the surrounding hardware. ESSAA is intended to work from outputs to inputs, as a complement to simulation and verification methods. Rather than treating the software in isolation, it examines the context in which the software is to be deployed. Given a specified disasterous outcome, ESSAA works from a qualitative, abstract model of the complete system to infer sets of environmental conditions and/or failures that could cause a disasterous outcome. The scenarios can then be examined in depth for plausibility using existing techniques. Author

N88-16397*# Martin Marietta Corp., Huntsville, Ala. Manned Space Systems.
INTELLIGENT PROCESS DEVELOPMENT OF FOAM MOLDING FOR THE THERMAL PROTECTION SYSTEM (TPS) OF THE SPACE SHUTTLE EXTERNAL TANK
S. S. Bharwani (Martin Marietta Corp., Baltimore, Md.), J. T. Walls, and M. E. Jackson *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 195-202 (For primary document see N88-16360 08-61)
(Contract NAS8-30300)
Avail: NTIS HC A18/MF A01 CSCL 09B

A knowledge based system to assist process engineers in evaluating the processability and moldability of poly-isocyanurate (PIR) formulations for the thermal protection system of the Space Shuttle external tank (ET) is discussed. The Reaction Injection Molding- Process Development Advisor (RIM-PDA) is a coupled system which takes advantage of both symbolic and numeric processing techniques. This system will aid the process engineer in identifying a startup set of mold schedules and in refining the mold schedules to remedy specific process problems diagnosed by the system. Author

N88-16398*# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
SPACE SHUTTLE MAIN ENGINE ANOMALY DATA AND INDUCTIVE KNOWLEDGE BASED SYSTEMS: AUTOMATED CORPORATE EXPERTISE
Kenneth L. Modesitt *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 203-212 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Progress is reported on the development of SCOTTY, an expert knowledge-based system to automate the analysis procedure following test firings of the Space Shuttle Main Engine (SSME). The integration of a large-scale relational data base system, a computer graphics interface for experts and end-user engineers, potential extension of the system to flight engines, application of the system for training of newly-hired engineers, technology transfer to other engines, and the essential qualities of good software engineering practices for building expert knowledge-based systems are among the topics discussed. R.J.F.

N88-16399*# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
AN EXPERT SYSTEM TO ANALYZE HIGH FREQUENCY DEPENDENT DATA FOR THE SPACE SHUTTLE MAIN ENGINE TURBOPUMPS c60
Raul C. Garcia, Jr. *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 213-220 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

The prototype expert system ADDAMX identifies selected sinusoid frequencies from spectral data graphs as speed frequencies and harmonics from each turbopump, frequency feed through from one turbopump to another, frequencies generated by turbopump bearings, pseudo 3N for the phase 2 high pressure fuel turbopump, and electrical noise. ADDAMX does the analysis in an interactive or batch mode and the results can be displayed on the screen or hardcopy. Author

N88-16400*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE USE AND GENERATION OF ILLUSTRATIVE EXAMPLES IN COMPUTER-BASED INSTRUCTIONAL SYSTEMS
William John Selig and James D. Johannes (Alabama Univ., Huntsville.) *In its* Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 221-226 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

A method is proposed whereby the underlying domain knowledge is represented such that illustrative examples may be generated on demand. This method has the advantage that the generated example can follow changes in the domain in addition to allowing automatic customization of the example to the individual. Author

N88-16401*# ICF/Phase Linear Systems, Inc., Fairfax, Va.
INTERACTIVE KNOWLEDGE ACQUISITION TOOLS c63
Martin J. Dudziak and Jerald L. Feinstein *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 227-232 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

The problems of designing practical tools to aid the knowledge engineer and general applications used in performing knowledge acquisition tasks are discussed. A particular approach was developed for the class of knowledge acquisition problem characterized by situations where acquisition and transformation of domain expertise are often bottlenecks in systems development. An explanation is given on how the tool and underlying software engineering principles can be extended to provide a flexible set of tools that allow the application specialist to build highly customized knowledge-based applications. Author

N88-16402*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AUTOMATIC MATHEMATICAL MODELING FOR SPACE APPLICATION

Caroline K. Wang *In its* Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 233-242 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

A methodology for automatic mathematical modeling is described. The major objective is to create a very friendly environment for engineers to design, maintain and verify their model and also automatically convert the mathematical model into FORTRAN code for conventional computation. A demonstration program was designed for modeling the Space Shuttle Main Engine simulation mathematical model called Propulsion System Automatic Modeling (PSAM). PSAM provides a very friendly and well organized environment for engineers to build a knowledge base for base equations and general information. PSAM contains an initial set of component process elements for the Space Shuttle Main Engine simulation and a questionnaire that allows the engineer to answer a set of questions to specify a particular model. PSAM is then able to automatically generate the model and the FORTRAN code. A future goal is to download the FORTRAN code to the VAX/VMS system for conventional computation. Author

N88-16403*# Alabama Univ., Huntsville.
LISP BASED SIMULATION GENERATORS FOR MODELING COMPLEX SPACE PROCESSES
Fan T. Tseng, Bernard J. Schroer, and Wen-Shing Dwan *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 243-247 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

The development of a simulation assistant for modeling discrete event processes is presented. Included are an overview of the system, a description of the simulation generators, and a sample process generated using the simulation assistant. Author

N88-16404*# McDonnell-Douglas Corp., St. Louis, Mo. Research Labs.
KNOWLEDGE-BASED SIMULATION
P. A. Newman *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 249-253 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

An architecture for a knowledge-based simulator is described. The task of scheduling represents an area in which such a tool might be applied. More specifically, scheduling for crew and ground support activities for the shuttle and space station would benefit from the application of knowledge-based simulation. The knowledge-based simulator would allow the crew and support personnel to schedule and reschedule activities in a timely and flexible manner in order to examine and test possible plans.
Author

N88-16405*# Martin Marietta Corp., Denver, Colo. Astronautics Group.
RAPID PROTOTYPING AND AI PROGRAMMING ENVIRONMENTS APPLIED TO PAYLOAD MODELING c63
Richard S. Carnahan, Jr. and Andrew P. Mendler *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 255-259 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

This effort focused on using artificial intelligence (AI) programming environments and rapid prototyping to aid in both space flight manned and unmanned payload simulation and training. Significant problems addressed are the large amount of development time required to design and implement just one of these payload simulations and the relative inflexibility of the resulting model to accepting future modification. Results of this effort have suggested that both rapid prototyping and AI programming environments can significantly reduce development time and cost when applied to the domain of payload modeling for crew training. The techniques employed are applicable to a variety of domains where models or simulations are required.
Author

N88-16406*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ORBITAL NAVIGATION, DOCKING AND OBSTACLE AVOIDANCE AS A FORM OF THREE DIMENSIONAL MODEL-BASED IMAGE UNDERSTANDING Abstract Only
J. Beyer, C. Jacobus, and B. Mitchell *In its* Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 261 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Range imagery from a laser scanner can be used to provide sufficient information for docking and obstacle avoidance procedures to be performed automatically. Three dimensional model-based computer vision algorithms in development can perform these tasks even with targets which may not be cooperative (that is, objects without special targets or markers to provide unambiguous location points). Roll, pitch and yaw of the vehicle can be taken into account as image scanning takes place, so that these can be corrected when the image is converted from egocentric to world coordinates. Other attributes of the sensor, such as the registered reflectence and texture channels, provide additional data sources for algorithm robustness. Temporal fusion of sensor immages can take place in the work coordinate domain, allowing for the building of complex maps in three dimensional space. Author

N88-16407*# Multisignal Technology Corp., Los Alamitos, Calif.
COMPUTING 3-D STRUCTURE OF RIGID OBJECTS USING STEREO AND MOTION
Thinh V. Nguyen *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 263-267 (For primary document see N88-16360 08-61)
(Contract NAS8-37308)
Avail: NTIS HC A18/MF A01 CSCL 09B

Work performed as a step toward an intelligent automatic machine vision system for 3-D imaging is discussed. The problem considered is the quantitative 3-D reconstruction of rigid objects. Motion and stereo are the two clues considered in this system. The system basically consists of three processes: the low level process to extract image features, the middle level process to establish the correspondence in the stereo (spatial) and motion (temporal) modalities, and the high level process to compute the 3-D coordinates of the corner points by integrating the spatial and temporal correspondences. Author

N88-16408*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REAL TIME AI EXPERT SYSTEM FOR ROBOTIC APPLICATIONS Abstract Only c63
John F. Follin *In its* Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 269-270 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

A computer controlled multi-robot process cell to demonstrate advanced technologies for the demilitarization of obsolete chemical munitions was developed. The methods through which the vision system and other sensory inputs were used by the artificial intelligence to provide the information required to direct the robots to complete the desired task are discussed. The mechanisms that the expert system uses to solve problems (goals), the different rule data base, and the methods for adapting this control system to any device that can be controlled or programmed through a high level computer interface are discussed. Author

N88-16409*# Alabama Univ., Huntsville. Center for Applied Optics.
SOLID MODELLING FOR THE MANIPULATIVE ROBOT ARM (POWER) AND ADAPTIVE VISION CONTROL FOR SPACE STATION MISSIONS Abstract Only c63
V. Harrand and A. Choudry *In* NASA. Marshall Space Flight

Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 271 (For primary document see N88-16360 08-61)
(Grant NAGw-847)
Avail: NTIS HC A18/MF A01 CSCL 09B

The structure of a flexible arm derived from concatenation of the Stewart-Table-based links were studied. Solid modeling provides not only a realistic simulation, but is also essential for studying vision algorithms. These algorithms could be used for the adaptive control of the arm, using the well-known algorithms such as shape from shading, edge detection, orientation, etc. Details of solid modeling and its relation to vision based adaptive control are discussed. Author

N88-16410*# Alabama Univ., Huntsville. Dept. of Computer Science.
ITERATIVE-DEEPENING HEURISTIC SEARCH FOR OPTIMAL AND SEMI-OPTIMAL RESOURCE ALLOCATION
Susan M. Bridges and James D. Johannes *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 273-277 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

It is demonstrated that when iterative-deepening A asterisk (IDA asterisk) is applied to one type of resource allocation problem, it uses far less storage than A asterisk, but opens far more nodes and thus has unacceptable time complexity. This is shown to be due, at least in part, to the low-valued effective branching factor that is a characteristic of problems with real-valued cost functions. The semi-optimal, epsilon-admissible IDA asterisk sub epsilon search algorithm that the authors described was shown to open fewer nodes than both A asterisk and IDA asterisk with storage complexity proportional to the depth of the search tree. Author

N88-16411*# ICF/Phase Linear Systems, Inc., Fairfax, Va.
SIMILARITY NETWORKS AS A KNOWLEDGE REPRESENTATION FOR SPACE APPLICATIONS **c62**
David Bailey, Donna Thompson, and Jerald Feinstein *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 279-284 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Similarity networks are a powerful form of knowledge representation that are useful for many artificial intelligence applications. Similarity networks are used in applications ranging from information analysis and case based reasoning to machine learning and linking symbolic to neural processing. Strengths of similarity networks include simple construction, intuitive object storage, and flexible retrieval techniques that facilitate inferencing. Therefore, similarity networks provide great potential for space applications. Author

N88-16412*# Alabama Univ., Huntsville. Dept. of Philosophy.
DISCOVERY AND PROBLEM SOLVING: TRIANGULATION AS A WEAK HEURISTIC
Daniel Rochowiak *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 285-289 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Recently the artificial intelligence community has turned its attention to the process of discovery and found that the history of science is a fertile source for what Darden has called compiled hindsight. Such hindsight generates weak heuristics for discovery that do not guarantee that discoveries will be made but do have proven worth in leading to discoveries. Triangulation is one such heuristic that is grounded in historical hindsight. This heuristic is explored within the general framework of the BACON, GLAUBER, STAHL, DALTON, and SUTTON programs. In triangulation different bases of information are compared in an effort to identify gaps between the bases. Thus, assuming that the bases of information are relevantly related, the gaps that are identified should be good locations for discovery and robust analysis. Author

N88-16413*# Alabama Univ., Tuscaloosa. Dept. of Computer Science.
COMMONALITY ANALYSIS AS A KNOWLEDGE ACQUISITION PROBLEM **c63**
Dorian P. Yeager *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 291-295 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Commonality analysis is a systematic attempt to reduce costs in a large scale engineering project by discontinuing development of certain components during the design phase. Each discontinued component is replaced by another component that has sufficient functionality to be considered an appropriate substitute. The replacement strategy is driven by economic considerations. The System Commonality Analysis Tool (SCAT) is based on an oversimplified model of the problem and incorporates no knowledge acquisition component. In fact, the process of arriving at a compromise between functionality and economy is quite complex, with many opportunities for the application of expert knowledge. Such knowledge is of two types: general knowledge expressible as heuristics or mathematical laws potentially applicable to any set of components, and specific knowledge about the way in which elements of a given set of components interrelate. Examples of both types of knowledge are presented, and a framework is proposed for integrating the knowledge into a more general and useable tool. Author

N88-16414*# Alabama Univ., Huntsville. Dept. of Computer Science.
QUALITATIVE MODELS FOR PLANNING: A GENTLE INTRODUCTION **c66**
James D. Johannes and James R. Carnes *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 297-302 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Qualitative modeling is the study of how the physical world behaves. These physical models accept partial descriptions of the world and output the possible changes. Current systems assume that the model is static and that physical entities do not effect change into the world. An approach to planning in physical domains and a working implementation which integrates qualitative models with a temporal interval-based planner are described. The planner constructs plans involving physical qualities and their behavioral descriptions. Author

N88-16415*# Bendix Field Engineering Corp., Lanham, Md.
OPERATIONAL ASPECTS OF A SPACECRAFT PLANNING/SCHEDULING EXPERT SYSTEM **c66**
David R. McLean, Ronald G. Littlefield, and David S. Beyer *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 303-307 (For primary document see N88-16360 08-61)
(Contract NAS5-27772)
Avail: NTIS HC A18/MF A01 CSCL 09B

Various operational aspects of the Earth Radiation Budget Satellite (ERBS) Tracking and Data Relay Satellite System (TDRSS) are described. The ERBS-TDRSS Contract Planning System is an expert system which has been used operationally since June 1987 by the ERBS Flight Operations Team (FOT) at Goddard Space Flight Center to build weekly schedules of requests for service from the TDRSS. The basic operation of the system and significant enhancements and changes are discussed. Author

N88-16416*# McDonnell-Douglas Corp., St. Louis, Mo. Artificial Intelligence Group.
PLANNING AND SCHEDULING FOR ROBOTIC ASSEMBLY **c66**
Barry R. Fox *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 309-313 (For primary document see N88-16360

08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

A system for reasoning about robotic assembly tasks is described. The first element of this system is a facility for itemizing the constraints which determine the admissible orderings over the activities to be sequenced. The second element is a facility which partitions the activities into independent subtasks and produces a set of admissible strategies for each. Finally, the system has facilities for constructing an admissible sequence of activities which is consistent with the given constraints. This can be done off-line, in advance of task execution, or it can be done incrementally, at execution time, according to conditions in the execution environment. The language of temporal constraints and the methods of inference presented in related papers are presented. It is shown how functional and spatial relationships between components impose temporal constraints on the order of assembly and how temporal constraints then imply admissible strategies and feasible sequences. Author

N88-16417*# Auburn Univ., Ala. Dept. of Computer Science and Engineering.
PLANNING ACTIVITIES IN SPACE c66
Kai-Hsiung Chang *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 315-319 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Three aspects of planning activities in space are presented. These include generating plans efficiently, coordinating actions among multiple agents, and recovering from plan execution errors. Each aspect is discussed separately. Author

N88-16418*# Alabama Univ., Huntsville. Research Inst.
INTELLIGENT MAN/MACHINE INTERFACES ON THE SPACE STATION c63
Rodney S. Daughtrey *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 321-325 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Some important topics in the development of good, intelligent, usable man/machine interfaces for the Space Station are discussed. These computer interfaces should adhere strictly to three concepts or doctrines: generality, simplicity, and elegance. The motivation for natural language interfaces and their use and value on the Space Station, both now and in the future, are discussed. Author

N88-16419*# General Digital Industries, Inc., Huntsville, Ala.
INTERFACING THE EXPERT: CHARACTERISTICS AND REQUIREMENTS FOR THE USER INTERFACE IN EXPERT SYSTEMS c66
Andrew Potter *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 327-331 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Because expert systems deal with new sets of problems presenting unique interface requirements, special issues requiring special attention are presented to user interface designers. External knowledge representation (how knowdedge is represented across the user interface), modes of user-system interdependence (advisory, cooperative, and autonomous), and management of uncertainty (deciding what actions to take or recommend based on incomplete evidence) are discussed. Author

N88-16420*# Alabama Univ., Huntsville. Cognitive Systems Lab.
SPACE LANGUAGES
Dan Hays *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 333-337 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Applications of linguistic principles to potential problems of human and machine communication in space settings are discussed. Variations in language among speakers of different backgrounds and change in language forms resulting from new experiences or reduced contact with other groups need to be considered in the design of intelligent machine systems. Author

N88-16421*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AN INNOVATIVE WORKSTATION c60
James Villarreal *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 339-344 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

A workstation was developed which uses the operator's eye movements and position to determine the placement of the cursor on a computer screen. A brainwave sensing technology overview and an introduction to the known rhythms or signals generated by the brain are given. This is followed by a descriptive explanation of the Ocular Attention Interface System (OASIS) and its intended integration into the proposed testbed. Author

N88-16422*# Knowledge Systems Concepts, Inc., Rome, N.Y.
CONCEPTUAL INFORMATION PROCESSING: A ROBUST APPROACH TO KBS-DBMS INTEGRATION
Allen V. Lazzara, William Tepfenhart, Richard C. White, and Raymond Liuzzi (Rome Air Development Center, Griffiss AFB, N.Y.) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 345-352 (For primary document see N88-16360 08-61)
(Contract F30602-85-C-0228)
Avail: NTIS HC A18/MF A01 CSCL 09B

Integrating the respective functionality and architectural features of knowledge base and data base management systems is a topic of considerable interest. Several aspects of this topic and associated issues are addressed. The significance of integration and the problems associated with accomplishing that integration are discussed. The shortcomings of current approaches to integration and the need to fuse the capabilities of both knowledge base and data base management systems motivates the investigation of information processing paradigms. One such paradigm is concept based processing, i.e., processing based on concepts and conceptual relations. An approach to robust knowledge and data base system integration is discussed by addressing progress made in the development of an experimental model for conceptual information processing. Author

N88-16423*# Boeing Aerospace Co., Huntsville, Ala.
FOUNDATION: TRANSFORMING DATA BASES INTO KNOWLEDGE BASES c82
R. B. Purves, James R. Carnes, and Dannie E. Cutts (Boeing Co., Huntsville, Ala.) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 353-357 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 05B

One approach to transforming information stored in relational data bases into knowledge based representations and back again is described. This system, called Foundation, allows knowledge bases to take advantage of vast amounts of pre-existing data. A benefit of this approach is inspection, and even population, of data bases through an intelligent knowledge-based front-end. Author

N88-16424*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE INTELLIGENT USER INTERFACE FOR NASA'S ADVANCED INFORMATION MANAGEMENT SYSTEMS Abstract Only c66
William J. Campbell, Nicholas Short, Jr., Larry H. Rolofs, and Scott

L. Wattawa (Science Applications Research, Landover, Md.) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 359-360 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

NASA has initiated the Intelligent Data Management Project to design and develop advanced information management systems. The project's primary goal is to formulate, design and develop advanced information systems that are capable of supporting the agency's future space research and operational information management needs. The first effort of the project was the development of a prototype Intelligent User Interface to an operational scientific database, using expert systems and natural language processing technologies. An overview of Intelligent User Interface formulation and development is given. Author

N88-16425*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
AN AI APPROACH FOR SCHEDULING SPACE-STATION PAYLOADS AT KENNEDY SPACE CENTER c66
D. Castillo (Harris Corp., Melbourne, Fla.), D. Ihrie, M. McDaniel, and R. Tilley *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 361-370 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

The Payload Processing for Space-Station Operations (PHITS) is a prototype modeling tool capable of addressing many Space Station related concerns. The system's object oriented design approach coupled with a powerful user interface provide the user with capabilities to easily define and model many applications. PHITS differs from many artificial intelligence based systems in that it couples scheduling and goal-directed simulation to ensure that on-orbit requirement dates are satisfied. Author

N88-16426*# Martin Marietta Aerospace, Denver, Colo. Space Systems.
SCHEDULING SPACECRAFT OPERATIONS c66
Daniel L. Britt, Amy L. Geoffroy, Philip R. Schaefer, and John R. Gohring (Martin Marietta Corp., Englewood, Colo.) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 371-376 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

A prototype scheduling system named MAESTRO currently under development is being used to explore possible approaches to the spacecraft operations scheduling problem. Results indicate that the appropriate combination of heuristic and other techniques can provide an acceptable solution to the scheduling problem over a wide range of operational scenarios and management approaches. These can include centralized or distributed instrument or systems control, batch or incremental scheduling, scheduling loose resource envelopes or exact profiles, and scheduling with varying degrees of user intervention. Techniques used within MAESTRO to provide this flexibility and power include constraint propagation mechanisms, multiple asynchronous processes, prioritized transaction-based command management, resource opportunity calculation, user-alterable selection and placement mechanisms, and maintenance of multiple schedules and resource profiles. These techniques and scheduling complexities requiring them are discussed. Author

N88-16427*# Computer Sciences Corp., Beltsville, Md. System Sciences Div.
THE RESOURCE ENVELOPE AS A BASIS FOR SPACE STATION MANAGEMENT SYSTEM SCHEDULING c66
Joy Bush and Anna Critchfield *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 377-381 (For primary document see N88-16360 08-61)
(Contract NAS5-28620)
Avail: NTIS HC A18/MF A01 CSCL 09B

The Platform Management System (PMS) Resource Envelope Scheduling System (PRESS) expert system prototype developed for space station scheduling is described. The purpose of developing the prototype was too investigate the resource envelope concept in a practical scheduling application, using a commercially available expert system shell. PRESS is being developed on an IBM PC/AT using Teknowledge, Inc.'s M.1 expert system shell. Author

N88-16428*# General Research Corp., Huntsville, Ala.
PROTOTYPE RESUPPLY SCHEDULER c66
Steve Tanner, Angi Hughes, and Jim Byrd (United Space Boosters, Inc., Huntsville, Ala.) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 383-387 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Resupply scheduling for the Space Station presents some formidable logistics problems. One of the most basic problems is assigning supplies to a series of shuttle resupply missions. A prototype logistics expert system which constructs resupply schedules was developed. This prototype is able to reconstruct feasible resupply plans. In addition, analysts can use the system to evaluate the impact of adding, deleting or modifying launches, cargo space, experiments, etc. Author

N88-16429*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
NEURAL NETWORK BASED SPEECH SYNTHESIZER: A PRELIMINARY REPORT c63
James A. Villarreal and Gary McIntire (Ford Aerospace and Communications Corp., Houston, Tex.) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 389-394 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

A neural net based speech synthesis project is discussed. The novelty is that the reproduced speech was extracted from actual voice recordings. In essence, the neural network learns the timing, pitch fluctuations, connectivity between individual sounds, and speaking habits unique to that individual person. The parallel distributed processing network used for this project is the generalized backward propagation network which has been modified to also learn sequences of actions or states given in a particular plan. Author

N88-16430*# Alabama Univ., Huntsville. Dept. of Computer Science.
THE POWER OF NEURAL NETS c63
J. P. Ryan and B. H. Shah *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 395-400 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Implementation of the Hopfield net which is used in the image processing type of applications where only partial information about the image may be available is discussed. The image classification type of algorithm of Hopfield and other learning algorithms, such as the Boltzmann machine and the back-propagation training algorithm, have many vital applications in space. Author

N88-16431*# Alabama Univ., Huntsville. Center for Applied Optics.
NEURAL NETWORKS AS A POSSIBLE ARCHITECTURE FOR THE DISTRIBUTED CONTROL OF SPACE SYSTEMS Abstract Only c63
E. Fiesler and A. Choudry *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 401 Sponsored by United Technologies (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Researchers attempted to identify the features essential for large, complex, multi-modular multi-functional systems possessing

a high level of interconnectivity. These features were studied in the context of neural networks with the aim of arriving at a possible architecture of the distributed control system-specific features of the neural networks and their applicability in space systems.
Author

N88-16432*# Alabama Univ., Huntsville. Dept. of Computer Science.
A DATA STRUCTURE AND ALGORITHM FOR FAULT DIAGNOSIS
Edward L. Bosworth, Jr. *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 403-407 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Results of preliminary research on the design of a knowledge based fault diagnosis system for use with on-orbit spacecraft such as the Hubble Space Telescope are presented. A candidate data structure and associated search algorithm from which the knowledge based system can evolve is discussed. This algorithmic approach will then be examined in view of its inability to diagnose certain common faults. From that critique, a design for the corresponding knowledge based system will be given. Author

N88-16433*# National Cash Register Co., Dayton, Ohio.
CASE-BASED REASONING FOR SPACE APPLICATIONS: UTILIZATION OF PRIOR EXPERIENCE IN KNOWLEDGE-BASED SYSTEMS c63
James A. King *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 409-413 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

The goal is to explain Case-Based Reasoning as a vehicle to establish knowledge-based systems based on experimental reasoning for possible space applications. This goal will be accomplished through an examination of reasoning based on prior experience in a sample domain, and also through a presentation of proposed space applications which could utilize Case-Based Reasoning techniques. Author

N88-16434*# Messerschmitt-Boelkow-Blohm/Entwicklungspring Nord, Bremen (West Germany). Space Systems Group.
KNOWLEDGE REPRESENTATION BY CONNECTION MATRICES: A METHOD FOR THE ON-BOARD IMPLEMENTATION OF LARGE EXPERT SYSTEMS c63
A. Kellner *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 415-419 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Extremely large knowledge sources and efficient knowledge access characterizing future real-life artificial intelligence applications represent crucial requirements for on-board artificial intelligence systems due to obvious computer time and storage constraints on spacecraft. A type of knowledge representation and corresponding reasoning mechanism is proposed which is particularly suited for the efficient processing of such large knowledge bases in expert systems. Author

N88-16435*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RB-ARD: A PROOF OF CONCEPT RULE-BASED ABORT Abstract Only
Richard Smith and John Marinuzzi *In its* Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 421 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

The Abort Region Determinator (ARD) is a console program in the space shuttle mission control center. During shuttle ascent, the Flight Dynamics Officer (FDO) uses the ARD to determine the possible abort modes and make abort calls for the crew. The goal of the Rule-based Abort region Determinator (RB/ARD) project was to test the concept of providing an onboard ARD for the shuttle or an automated ARD for the mission control center (MCC). A proof of concept rule-based system was developed on a LMI Lambda computer using PICON, a knowdedge-based system shell. Knowdedge derived from documented flight rules and ARD operation procedures was coded in PICON rules. These rules, in conjunction with modules of conventional code, enable the RB-ARD to carry out key parts of the ARD task. Current capabilities of the RB-ARD include: continuous updating of the available abort mode, recognition of a limited number of main engine faults and recommendation of safing actions. Safing actions recommended by the RB-ARD concern the Space Shuttle Main Engine (SSME) limit shutdown system and powerdown of the SSME Ac buses.
Author

N88-16436*# Inference Corp., Los Angeles, Calif.
A LEARNING APPRENTICE FOR SOFTWARE PARTS COMPOSITION
Bradley P. Allen and Peter L. Holtzman *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 423-424 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

An overview of the knowledge acquisition component of the Bauhaus, a prototype computer aided software engineering (CASE) workstation for the development of domain-specific automatic programming systems (D-SAPS) is given. D-SAPS use domain knowledge in the refinement of a description of an application program into a compilable implementation. The approach to the construction of D-SAPS was to automate the process of refining a description of a program, expressed in an object-oriented domain language, into a configuration of software parts that implement the behavior of the domain objects. Author

N88-16437*# Florida International Univ., Miami. School of Computer Science.
AUTOMATIC PROGRAM GENERATION FROM SPECIFICATIONS USING PROLOG Abstract Only
Alex Pelin and Paul Morrow (Air Force Weapons Lab., Kirtland AFB, N. Mex.) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 425 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

An automatic program generator which creates Prolog programs from input/output specifications is presented. The generator takes as input descriptions of the input and output data types, a set of tests, a set of transformations and the input/out relation. Abstract data types are used as models. The tests, the transformations and the input/out relation are also specified by equations. The heuristics used by the automatic propram generator in building Prolog programs are discussed. Author

N88-16438*# Alabama Univ., Huntsville. Dept. of Computer Science.
ON ACQUISITION OF PROGRAMMING KNOWLEDGE
Ashok T. Amin *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 427-431 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

For the evolving discipline of programming, acquisition of programming knowledge is a difficult issue. Common knowledge results from the acceptance of proven techniques based on results of formal inquiries into the nature of the programming process. This is a rather slow process. In addition, the vast body of common knowledge needs to be explicated to a low enough level of details for it to be represented in the machine processable form. It is felt that this is an impediment to the progress of automatic programming. The importance of formal approaches cannot be overstated since their contributions lead to quantum leaps in the state of the art. Author

N88-16439*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPLICATION OF ARTIFICIAL INTELLIGENCE TO IMPULSIVE ORBITAL TRANSFERS c63
Rowland E. Burns *In its* Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 433-437 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

A generalized technique for the numerical solution of any given class of problems is presented. The technique requires the analytic (or numerical) solution of every applicable equation for all variables that appear in the problem. Conditional blocks are employed to rapidly expand the set of known variables from a minimum of input. The method is illustrated via the use of the Hohmann transfer problem from orbital mechanics. Author

N88-16440*# Arinc Research Corp., Fountain Valley, Calif.
A FRAMEWORK FOR REAL-TIME DISTRIBUTED EXPERT SYSTEMS: ON-ORBIT SPACECRAFT FAULT DIAGNOSIS, MONITORING AND CONTROL
Richard L. Mullikin *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 439-443 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Control of on-orbit operation of a spacecraft requires retention and application of special purpose, often unique, knowledge of equipment and procedures. Real-time distributed expert systems (RTDES) permit a modular approach to a complex application such as on-orbit spacecraft support. One aspect of a human-machine system that lends itself to the application of RTDES is the function of satellite/mission controllers - the next logical step toward the creation of truly autonomous spacecraft systems. This system application is described. Author

N88-16441*# Hamilton Standard, Windsor Locks, Conn.
TES: A MODULAR SYSTEMS APPROACH TO EXPERT SYSTEM DEVELOPMENT FOR REAL TIME SPACE APPLICATIONS Abstract Only
Brenda England and Ralph Cacace *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 445 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

A major goal of the space station era is to reduce reliance on support from ground based experts. The TIMES Expert System (TES) is an application that monitors and evaluates real time data to perform fault detection and fault isolation as it would otherwise be carried out by a knowledgeable designer. The development process and primary features of the TES, the modular system and the lessons learned are discussed. Author

N88-16442*# Honeywell, Inc., Clearwater, Fla. Space and Strategic Avionics Div.
PROTOTYPE SPACE STATION AUTOMATION SYSTEM DELIVERED AND DEMONSTRATED AT NASA c63
Roger F. Block *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 447-451 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

The Automated Subsystem Control for Life Support System (ASCLSS) program has successfully developed and demonstrated a generic approach to the automation and control of Space Station subsystems. The hierarchical and distributed real time controls system places the required controls authority at every level of the automation system architecture. As a demonstration of the automation technique, the ASCLSS system automated the Air Revitalization Group (ARG) of the Space Station regenerative Environmental Control and Life Support System (ECLSS) using real-time, high fidelity simulators of the ARG processess. This automation system represents an early flight prototype and an important test bed for evaluating Space Station controls technology including future application of ADA software in real-time control and the development and demonstration of embedded artificial intelligence and expert systems (AI/ES) in distributed automation and controls systems. Author

N88-16443*# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
APPLICATIONS OF EXPERT SYSTEMS FOR SATELLITE AUTONOMY c63
A. Ciarlo and P. Donzelli (LABEN Space Instrumentation and Systems, Milan, Italy) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 453-457 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

Some aspects of the on-board application of expert systems in artificial satellites are discussed. The activities of the study, which include the implementation of two prototypes on a dedicated artificial intelligence machine, are described. The general implications of the experience are then discussed. These concern the interrelationship between the expert system and the architecture of the satellite and the expert system's impact on the mission definition phase of the satellite lifecycle. The main obstacles that need to be overcome before operational use of onboard expert systems can take place are discussed. Author

N88-16444# Texas Univ., Austin. Center for Numerical Analysis.
A PARALLEL ALGORITHM FOR THE GENERAL LU-FACTORIZATION
D. R. Kincaid and T. C. Oppe Apr. 1987 20 p Presented at the Advances in Computational Methods Workshop, Dallas, Tex., 13 Apr. 1987
(Contract DE-AS05-81ER-10954)
(DE88-002177; CONF-8704224-1; CNA-209) Avail: NTIS HC A03/MF A01

An algorithm for computing in parallel the general LU-factorization of a matrix is presented. As special cases, one obtains the Doolittle, Crout, and Cholesky methods. The algorithm was implemented and tested on the Cray X-MP/48. DOE

N88-16445# Texas Univ., Austin. Center for Numerical Analysis.
NUMERICAL EXPERIMENTS WITH A PARALLEL CONJUGATE GRADIENT METHOD
T. C. Oppe and D. R. Kincaid Apr. 1987 22 p Presented at the 6th IMACS International Symposium on Computer Methods for Partial Differential Equations, Bethlehem, Pa., 23 Jun. 1987
(Contract DE-AS05-81ER-10954)
(DE88-002178; CONF-870677-10; CNA-208) Avail: NTIS HC A02/MF A01

A parallel version of the conjugate gradient method introduced by Seager is implemented using various Cray multitasking tools. The parallel algorithm is used to solve a model partial differential equation on the unit square for various mesh sizes. Speed-up factors are given, and the effects of bank conflicts are noted. DOE

N88-16446*# Sperry Space Systems, Phoenix, Ariz. Space Systems.
MEDIA INDEPENDENT INTERFACE Final Report
21 Jul. 1987 89 p
(Contract NAS9-17383)
(NASA-CR-172033; NAS 1.26:172033; MS-2-2-5250) Avail: NTIS HC A05/MF A01 CSCL 09B

The work done on the Media Independent Interface (MII) Interface Control Document (ICD) program is described and recommendations based on it were made. Explanations and rationale for the content of the ICD itself are presented. B.G.

N88-16447*# Sperry Corp., Phoenix, Ariz. Space Systems.
MEDIA INDEPENDENT INTERFACE. INTERFACE CONTROL DOCUMENT
21 Jul. 1987 60 p
(Contract NAS9-17383)
(NASA-CR-172032; NAS 1.26:172032; MS-2-2-5250) Avail: NTIS HC A04/MF A01 CSCL 09B

A Media Independent Interface (MII) is specified, using current standards in the industry. The MII is described in hierarchical fashion. At the base are IEEE/International Standards Organization (ISO) documents (standards) which describe the functionality of the software modules or layers and their interconnection. These documents describe primitives which are to transcent the MII. The intent of the MII is to provide a universal interface to one or more Media Access Contols (MACs) for the Logical Link Controller and Station Manager. This interface includes both a standardized electrical and mechanical interface and a standardized functional specification which defines the services expected from the MAC. B.G.

N88-16448*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE CRUSTAL DYNAMICS INTELLIGENT USER INTERFACE ANTHOLOGY
Nicholas M. Short, Jr., William J. Campbell, Larry H. Roelofs, and Scott L. Wattawa (Science Applications Research, Lanham, Md.) Oct. 1987 57 p
(NASA-TM-100693; NAS 1.15:100693) Avail: NTIS HC A04/MF A01 CSCL 09B

The National Space Science Data Center (NSSDC) has initiated an Intelligent Data Management (IDM) research effort which has, as one of its components, the development of an Intelligent User Interface (IUI). The intent of the IUI is to develop a friendly and intelligent user interface service based on expert systems and natural language processing technologies. The purpose of such a service is to support the large number of potential scientific and engineering users that have need of space and land-related research and technical data, but have little or no experience in query languages or understanding of the information content or architecture of the databases of interest. This document presents the design concepts, development approach and evaluation of the performance of a prototype IUI system for the Crustal Dynamics Project Database, which was developed using a microcomputer-based expert system tool (M. 1), the natural language query processor THEMIS, and the graphics software system GSS. The IUI design is based on a multiple view representation of a database from both the user and database perspective, with intelligent processes to translate between the views. Author

N88-16449# Research Inst. of National Defence, Stockholm (Sweden).
DEVELOPMENT OF A COMPUTER MODEL FOR MISSILE SIMULATION, OR SIMULATION OF A KINETIC COVERAGE AREA FOR A TARGET DETECTION MISSILE
Hans Johansson and Claes Hornstrand Aug. 1987 131 p In SWEDISH; ENGLISH summary
(FOA-C-20666-2.5; ISSN-0347-3694; ETN-88-91396) Avail: NTIS HC A07/MF A01

An interactive computer program for robot simulation is described. The path of a homing missile is simulated when shot against a moving target. It is possible to generate the coverage area by firing the missile towards the target at different times and positions. The missile is of the surface to air type. The model is three-dimensional. The program is a mathematical model coded in Ada. The missile path is generated by integration with the Runge-Kutta method. The variability of viscosity of air and speed of sound with the height is taken into account. ESA

N88-16450# Research Inst. of National Defence, Stockholm (Sweden).
DEVELOPMENT OF A COMPUTER MODEL FOR MISSILE SIMULATION, OR SIMULATION OF A KINETIC COVERAGE AREA FOR A COLLIMATION GUIDED MISSILE
Claes Hornstrand and Hans Johansson Aug. 1987 81 p In SWEDISH; ENGLISH summary
(FOA-C-20667-2.5; ISSN-0347-3694; ETN-88-91397) Avail: NTIS HC A05/MF A01

An interactive computer program for robot simulation is described. The path of a collimation guided missile is simulated when shot against a moving target. It is possible to generate the coverage area by firing the missile towards the target at different times and positions. The missile is of surface to air type. The model is three-dimensional. The program is a mathematical model coded in Ada. The missile path is generated by integration with the Runge-Kutta method. The variability of viscosity of air and speed of sound with the height are taken into account. ESA

N88-16451# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Operations Research and System Theory.
A NOTE ON THE PARTITIONING SHORTEST PATH ALGORITHM
Martin Desrochers Feb. 1987 8 p Submitted for publication Sponsored by a NATO Science Fellowship
(CWI-OS-R8703; B8711095; ETN-88-91582) Copyright Avail: NTIS HC A02/MF A01

A step is added to the partitioning shortest path algorithm. It results in variants scanning from sharp labels and having computational complexity O(abs.val.N cubed) for two of them and O(abs.val N sq) for the other. This step also provides a test for the early detection of negative length cycles. ESA

N88-16452*# Essex Corp., Orlando, Fla.
DEVELOPMENT OF A MENU OF PERFORMANCE TESTS SELF-ADMINISTERED ON A PORTABLE MICROCOMPUTER
Robert L. Wilkes, Lois-Ann Kuntz, and Robert S. Kennedy 16 Oct. 1987 40 p
(Contract NAS9-17326)
(NASA-CR-172040; NAS 1.26:172040) Avail: NTIS HC A03/MF A01 CSCL 09B

Eighteen cognitive, motor, and information processing performance subtests were screened for self-administration over 10 trials by 16 subjects. When altered presentation forms of the same test were collectively considered, the battery composition was reduced to 10 distinctly different measures. A fully automated microbased testing system was employed in presenting the battery of subtests. Successful self-administration of the battery provided for the field testing of the automated system and facilitated convenient data collection. Total test administration time was 47.2 minutes for each session. Results indicated that nine of the tests stabilized, but for a short battery of tests only five are recommended for use in repeated-measures research. The five recommended tests include: the Tapping series, Number Comparison, Short-term Memory, Grammatical Reasoning, and 4-Choice Reaction Time. These tests can be expected to reveal three factors: (1) cognition, (2) processing quickness, and (3) motor. All the tests stabilized in 24 minutes, or approximately two 12-minute sessions. Author

N88-16453# Amsterdam Univ. (Netherlands). Dept. of Computer Science.
INFORMATION HANDLING ARCHITECTURE AND SOFTWARE FOR CIM (COMPUTER INTEGRATED MANUFACTURING)
L. O. Hertzberger Jan. 1987 18 p
(PB88-105820; FVI-87-03) Avail: NTIS HC A03/MF A01 CSCL 09B

Information handling for Computer Integrated Manufacturing (CIM) deals with all areas where the computer is used to support a more effective production process. For the exchange of information between shopfloor machines mostly Local Area Networks (LAN) technology is applied. In contradiction to the application of Information Technology (IT) in most other CIM areas,

a proposal for standardized information exchange exists for the purpose. This is the General Motors proposal for the specification of the Manufacturing Automation Protocol (MAP). These specifications are based on the Open System Interconnect (OSI) model of the International Standard Organization (ISO). The emphasis is on the introduction of IT in CIM. The possibilities of existing technology as well as some of the research aiming to create possibilities in the future are discussed. GRA

N88-16454# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DIGITAL IMAGE PROCESSING: A SUMMARY OF MAIN TECHNIQUES [PROCESSAMENTO DIGITAL DE IMAGENS: UM RESUMO DAS PRINCIPAIS TECNICAS]
Nelson DelfinodAvilaMascarenhas Oct. 1987 11 p In PORTUGUESE; ENGLISH summary Presented at the Information Seminar, Saude, Porto Alegre, 19-22 Oct. 1987
(INPE-4404-PRE/1220) Avail: NTIS HC A03/MF A01

The main techniques for digital image processing are reviewed, i.e., digitization, enhancement, restoration, reconstruction, coding and image analysis. Author

N88-16455# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STANDARDIZATION OF SOFTWARE DEVELOPMENT [PADRONIZACAO DE DESENVOLVIMENTO DE SOFTWARE]
Julia LeocadiadeOliveira, Mitsugu Kato, Orion deOliveiraSilva, Paulo G. Milani, Valcir Orlando, and Wilson Yamaguti Sep. 1987 107 p In PORTUGUESE; ENGLISH summary
(INPE-4330-NTE/272) Avail: NTIS HC A06/MF A01

A proposal of standardization for the development of software based on its life cycle is presented. Such standardization involves activities to be developed, documentation to be produced, and tools to be used in each phase of the software development. Author

N88-16456# Argonne National Lab., Ill.
USER'S GUIDE TO DIANE: A MICROCOMPUTER PROGRAM FOR MODELING BATTERY PERFORMANCE IN ELECTRIC VEHICLES
W. W. Marr, W. J. Walsh, and P. C. Symons Sep. 1987 42 p
(Contract W-31-109-eng-38)
(DE88-003713; ANL/CNSV-TM-190) Avail: NTIS HC A03/MF A01

A microcomputer program (DIANE) is developed to model changing electric-vehicle (EV) performance capability as a function of operating history. The objective is to enable the accurate prediction of EV performance on the basis of laboratory bench data for batteries. The model provides a second-by-second simulation of battery voltage and current for any specified power/time profile and includes possible recuperation effects during vehicle rest periods. The electric vehicle is simulated by algorithms relating the battery power required for a particular maneuver to the corresponding velocity/time profile. The resulting power/time profile is then compared with the battery capability. The latter is simulated by an algorithm relating the battery voltage and the current being withdrawn. Depth-of-discharge and aging effects are computed during simulated driving over a user-selected driving pattern, and the performance capability of the EV is determined periodically. The simulation continues until the battery capability is insufficient to meet the mission requirements set by the user. DIANE is a user-friendly, interactive microcomputer software package programmed in FORTRAN. DOE

N88-16457# Argonne National Lab., Ill.
PROSPECTUS FOR THE DEVELOPMENT OF A LINEAR ALGEBRA LIBRARY FOR HIGH-PERFORMANCE COMPUTERS
J. Demmell, J. J. Dongarra, J. DuCroz, A. Greenbaum, S. Hammarling, and D. Sorensen Sep. 1987 10 p
(Contract W-31-109-eng-38)
(DE88-003715; ANL/MCS-TM-97) Avail: NTIS HC A02/MF A01

A transportable linear algebra library in Fortran 77 for efficient use on high-performance computers is proposed. The library is intended to provide a uniform set of subroutines to solve the most common linear algebra problems and to run efficiently on a wide range of architectures. This library, which will be freely accessible via computer network, not only will ease code development, make codes more portable among machines of different architectures, and increase efficiency, but also will provide tools for evaluating computer performance. The library will be based on the well-known and widely used LINPACK and EISPACK packages for linear equation solving, eigenvalue problems, and linear least squares. LINPACK and EISPACK have provided an important infrastructure for scientific computing on serial machines, but they were not designed to exploit the profusion of parallel and vector architectures not becoming available. We propose to restructure the algorithms in terms of calls to a small number of extended Basic Linear algebra Subroutines each of which implements a basic operation such as matrix multiplication, rank-k matrix updates, and the solution of triangular systems. These operations can be optimized for each architecture, but the underlying numerical algorithms will be the same for all machines. DOE

N88-16458# Ohio State Univ., Columbus. ElectroScience Lab.
SHORT DATA LENGTH EFFECTS IN AN ASYMPTOTICALLY EFFICIENT ARMA (AUTOREGRESSIVE MOVING AVERAGE) SPECTRAL ESTIMATOR
C. Carriere and R. L. Moses Jul. 1987 84 p
(Contract N00014-85-K-0321)
(AD-A186561; ESL-717220-5) Avail: NTIS HC A05/MF A01
CSCL 09B

The short data length behaviour of a recently proposed computationally efficient approximate maximum likelihood estimation algorithm is studied through Monte Carlo simulations. It is found that short data lengths combined with a large number of instruments results in very high variances, especially when the process being estimated has zeros near the unit circle. Several modifications of the algorithm are considered to reduce the problem mentioned above. First, a version which is recursive in the number of instruments and which adaptively chooses the number of instruments and postiterations is developed. A second modification uses a stabilized version of the estimated denominator polynomial. A version that forces the numerator estimate to non negative definite is considered, but it fails to give major improvements over the original algorithm. Finally, using overdetermined Yule Walker equations instead of the minimal number is found to markedly improve the quality of the estimates. GRA

62 COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

N88-16459# Lawrence Livermore National Lab., Calif.
APPLICATIVE PARALLELISM: POTENTIAL AND CHALLENGE
R. R. Oldehoeft and D. C. Cann (Colorado State Univ., Fort Collins.) 1988 26 p Presented at the Hawaii International Conference on Systems Sciences, Kailua-Kona, Hawaii, 5-8 Jan. 1988
(Contract W-7405-eng-48)
(DE87-011885; UCRL-96781; CONF-880114-1) Avail: NTIS HC A03/MF A01

The applicative model of computation makes possible the development of programming languages with several attractive features. Programs may be proved to execute correctly. Features of these languages remove some sources of programmer error, and can make correct programs easier to build and maintain. In this report we discuss how software for applicative language programs can automatically detect and exploit parallelism to take advantage of current and future parallel processing systems. We use an applicative language, SISAL, to show the sources of parallelism. A prototype SISAL system is available to execute some

sample programs and help us examine how well the implementation exploits potential parallelism. An outstanding problem in applicative language design and implementation is copy optimization. The single assignment semantics of these languages requires frequent data structure copying in some programs. We exemplify the importance of doing this optimization well, and show that high-quality code generation is also important for applicative languages. DOE

N88-16460# Maryland Univ., College Park. Inst. for Advanced Computer Studies.
SAHAYOG: A TESTBED FOR LOAD SHARING UNDER FAILURE
Piyush Dikshit and Satish K. Tripathi Jul. 1987 39 p
(Contract N00014-87-K-0124)
(AD-A186615; UMIACS-TR-87-34; CS-TR-1891) Avail: NTIS HC A03/MF A01 CSCL 09B

This paper describes the implementation of a testbed for distributed load sharing in a broadcast local area network consisting of AT&T 3B2 minicomputers. The testbed is designed to evaluate dynamic load sharing policies which use the process migration approach. It contains an optional fault-tolerance feature to handle single-node failures. Five load sharing algorithms are implemented and evaluated using the testbed under different loading conditions and for various parameter values. The experiments done using these algorithms confirm some earlier results about load sharing and also provide some new insights. GRA

N88-16393*# TRW Defense and Space Systems Group, Huntsville, Ala.
APPLICATION OF PARALLEL DISTRIBUTED PROCESSING TO SPACE BASED SYSTEMS
J. R. MacDonald and H. L. Heffelfinger *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 171-180 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16411*# ICF/Phase Linear Systems, Inc., Fairfax, Va.
SIMILARITY NETWORKS AS A KNOWLEDGE REPRESENTATION FOR SPACE APPLICATIONS
David Bailey, Donna Thompson, and Jerald Feinstein *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 279-284 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

63 CYBERNETICS

Includes feedback and control theory, artificial intelligence, robotics and expert systems.

For related information see also *54 Man/System Technology and Life Support.*

N88-16461# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Operations Research and System Theory.
ADAPTIVE EXPONENTIAL STABILIZATION OF A FIRST ORDER CONTINUOUS-TIME SYSTEM
J. W. Polderman Mar. 1987 11 p Submitted for publication
(CWI-OS-R8705; B8711097; ETN-88-91584) Copyright Avail: NTIS HC A03/MF A01

An algorithm for adaptive pole-placement for the class of first order continuous-time systems is proposed. The asymptotic properties of the algorithm do not depend on the presence of persistently exciting signals. Excitation is used only initially to avoid that parameter estimates become noncontrollable. The main result is that the asymptotic behavior of the system equals the behavior obtained on the basis of the true system. Identification of the system-parameters however, does not necessarily take place. The reason that such a result can be obtained without identification of the true system is the following: suppose a wrong estimate of the system is used to generate the controls, and that the incorrectness of the estimate is not revealed by the resulting closed-loop behavior of the system, then the inputs are exactly equal to the ones which would be applied if the system was known. ESA

N88-16462# Illinois Univ., Urbana. Coordinated Science Lab.
SUBSTRUCTURE DISCOVERY IN EXECUTED ACTION SEQUENCES M.S. Thesis
Bradley L. Whitehall 16 Sep. 1987 82 p
(Contracts N00014-82-K-0186; N00014-85-K-0078)
(AD-A186446; UILU-ENG-87-2256) Avail: NTIS HC A05/MF A01 CSCL 09B

This thesis describes a system, PLAND (Plan Discovery) for discovering substructures in observed action sequences. The goal of this thesis is to show how a system can learn useful macro operators by observing a task being performed. An intelligent robot using this system can learn how to perform new tasks by watching tasks being performed by someone else, even if the robot does not possess a complete understanding for the actions being observed. There may be more than one hypothesis of how an action (or macro operator) contributes to the completion of a task and PLAND allows for these various meanings to be pursued simultaneously. Macro operators are discovered within a specific context that provides the types of generalizations allowed in the discovery process and uses the previously proposed macro operators to build new ones. Background knowledge is used to determine which generalizations are appropriate and to control search. Although the system can discover simple syntactic structures (regular grammars) without background knowledge, more meaningful and useful structures are discovered when background knowledge is incorporated into the process. GRA

N88-16463# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
CONTROL VARIATE SELECTION FOR MULTIRESPONSE SIMULATION Ph.D. Thesis
Kenneth W. Bauer, Jr. May 1987 208 p
(AD-A186637; AFIT/CI/NR-87-132D) Avail: NTIS HC A10/MF A01 CSCL 09B

A solution is offered to the general problem of optimal selection of control variates. Solutions are offered for two different cases of the general problem: when the covariance matrix of the controls is unknown, and when the covariance matrix of the controls is known and is incorporated into point and confidence region estimators. For the second case a new estimator is introduced. Under the assumption that the responses and the controls are jointly normal, the unbiasness of this new estimator is established, and its dispersion matrix is derived. A selection algorithm is implemented which locates the optimal subset of controls. The algorithm is based on criteria derived for the two cases listed above. A promising new class of controls is introduced which are called routing variables. The asymptotic distribution of these controls is derived as well as their asymptotic mean and variance. Finally, the performance of the selection algorithm is investigated and the new estimator is contrasted with the classical estimator. GRA

N88-16364*# Vanderbilt Univ., Nashville, Tenn. Center for Intelligent Systems.
METHODOLOGY FOR TESTING AND VALIDATING KNOWLEDGE BASES
C. Krishnamurthy, S. Padalkar, J. Sztipanovits, and B. R. Purves (Boeing Aerospace Co., Huntsville, Ala.) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 21-32 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16369*# Alabama Univ., Huntsville. Research Center.
ISSUES ASSOCIATED WITH TELEROBOTIC SYSTEMS IN SPACE
Scott A. Hofacker and Bernard J. Schroer *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for

Space Applications, Part 1 Nov. 1987 p 59-64 Sponsored in part by Boeing Aerospace Co. and Alabama Research Inst. (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16370*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
TELEROBOTIC CONTROLLER DEVELOPMENT
W. S. Otaguro, L. O. Kesler (McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.), Ken Land, and Don Rhoades *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 65-71 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16371*# Alabama Univ., Huntsville. Research Center.
SOFTWARE SIMULATION OF TIME DELAY IN TELEOPERATION
K. Wayne Goode *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 73-77 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16372*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MTK: AN AI TOOL FOR MODEL-BASED REASONING Abstract Only
William K. Erickson and Mary R. Schwartz *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 79 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16376*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MONITORING OF SPACE STATION LIFE SUPPORT SYSTEMS WITH MINIATURE MASS SPECTROMETRY AND ARTIFICIAL INTELLIGENCE Abstract Only
Richard A. Yost, Jodie V. Johnson (Florida State Univ., Gainesville.), and Carla M. Wong *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 87 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16380*# Lockheed Missiles and Space Co., Menlo Park, Calif. Artificial Intelligence Center.
A KNOWLEDGE-BASED SYSTEM FOR MONITORING THE ELECTRICAL POWER SYSTEM OF THE HUBBLE SPACE TELESCOPE
Pat Eddy *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 103-107 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16381*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ARTIFICIAL INTELLIGENCE AND SPACE POWER SYSTEMS AUTOMATION
David J. Weeks *In its* Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 109-113 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16382*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EMBEDDED EXPERT SYSTEM FOR SPACE SHUTTLE MAIN ENGINE MAINTENANCE
J. Pooley, W. Thompson, T. Homsley, W. Teoh (Sparta, Inc., Huntsville, Ala.), J. Jones, and P. Lewallen *In its* Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 115-119 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16383*# Tennessee Univ. Space Inst., Tullahoma.
QUALITATIVE AND TEMPORAL REASONING IN ENGINE BEHAVIOR ANALYSIS Abstract Only
W. E. Dietz, M. E. Stamps, and M. Ali *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 121-122 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16384*# General Electric Co., Philadelphia, Pa. Astro-Space Div.
EXPLORING HYPOTHESES IN ATTITUDE CONTROL FAULT DIAGNOSIS
Benjamin Bell *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 123-130 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16385*# Messerschmitt-Boelkow-Blohm/Entwicklungsring Nord, Bremen (West Germany). Space Systems Group.
EUREX D: AN EXPERT SYSTEM FOR FAILURE DIAGNOSIS AND RECOVERY IN THE TCS OF THE EUROPEAN RETRIEVABLE CARRIER EURECA
A. Kellner, W. Belau, and N. Schielow *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 131-135 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16386*# Alabama Univ., Huntsville. Research Center.
TASK PATH PLANNING, SCHEDULING AND LEARNING FOR FREE-RANGING ROBOT SYSTEMS
G. Steve Wakefield *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 137-141 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16387*# Vanderbilt Univ., Nashville, Tenn. Center for Intelligent Systems.
DEVELOPMENT OF A TASK-LEVEL ROBOT PROGRAMMING AND SIMULATION SYSTEM
H. Liu, K. Kawamura, S. Narayanan, G. Zhang, H. Franke, M. Ozkan, and H. Arima (Tokico Ltd., Kawasaki, Japan) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 143-149 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16388*# Alabama Univ., Huntsville. Center for Applied Optics.
GOAL DRIVEN KINEMATIC SIMULATION OF FLEXIBLE ARM ROBOT FOR SPACE STATION MISSIONS Abstract Only
P. Janssen and A. Choudry *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 151 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16389*# Technische Hogeschool, Delft (Netherlands). Faculty of Applied Physics.
HEURISTIC SEARCH IN ROBOT CONFIGURATION SPACE USING VARIABLE METRIC Abstract Only
Ben J. H. Verwer *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 (date) 153-154 (SEE N88-16360 08-61) Nov. 1987 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16392*# Louisiana State Univ., Baton Rouge. Dept. of Computer Science.
PROBLEM SOLVING AS INTELLIGENT RETRIEVAL FROM DISTRIBUTED KNOWLEDGE SOURCES
Zhengxin Chen *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 165-169 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16401*# ICF/Phase Linear Systems, Inc., Fairfax, Va.
INTERACTIVE KNOWLEDGE ACQUISITION TOOLS
Martin J. Dudziak and Jerald L. Feinstein *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 227-232 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16405*# Martin Marietta Corp., Denver, Colo. Astronautics Group.
RAPID PROTOTYPING AND AI PROGRAMMING ENVIRONMENTS APPLIED TO PAYLOAD MODELING
Richard S. Carnahan, Jr. and Andrew P. Mendler *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 255-259 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16408*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REAL TIME AI EXPERT SYSTEM FOR ROBOTIC APPLICATIONS Abstract Only
John F. Follin *In its* Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 269-270 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16409*# Alabama Univ., Huntsville. Center for Applied Optics.
SOLID MODELLING FOR THE MANIPULATIVE ROBOT ARM (POWER) AND ADAPTIVE VISION CONTROL FOR SPACE STATION MISSIONS Abstract Only
V. Harrand and A. Choudry *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 271 (For primary document see N88-16360 08-61)
(Grant NAGw-847)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16413*# Alabama Univ., Tuscaloosa. Dept. of Computer Science.
COMMONALITY ANALYSIS AS A KNOWLEDGE ACQUISITION PROBLEM
Dorian P. Yeager *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 291-295 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16418*# Alabama Univ., Huntsville. Research Inst.
INTELLIGENT MAN/MACHINE INTERFACES ON THE SPACE STATION
Rodney S. Daughtrey *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 321-325 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16429*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
NEURAL NETWORK BASED SPEECH SYNTHESIZER: A PRELIMINARY REPORT
James A. Villarreal and Gary McIntire (Ford Aerospace and Communications Corp., Houston, Tex.) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 389-394 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16430*# Alabama Univ., Huntsville. Dept. of Computer Science.
THE POWER OF NEURAL NETS
J. P. Ryan and B. H. Shah *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 395-400 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16431*# Alabama Univ., Huntsville. Center for Applied Optics.
NEURAL NETWORKS AS A POSSIBLE ARCHITECTURE FOR THE DISTRIBUTED CONTROL OF SPACE SYSTEMS Abstract Only
E. Fiesler and A. Choudry *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 401 Sponsored by United Technologies (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16433*# National Cash Register Co., Dayton, Ohio.
CASE-BASED REASONING FOR SPACE APPLICATIONS: UTILIZATION OF PRIOR EXPERIENCE IN KNOWLEDGE-BASED SYSTEMS
James A. King *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 409-413 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16434*# Messerschmitt-Boelkow-Blohm/Entwicklungsring Nord, Bremen (West Germany). Space Systems Group.
KNOWLEDGE REPRESENTATION BY CONNECTION MATRICES: A METHOD FOR THE ON-BOARD IMPLEMENTATION OF LARGE EXPERT SYSTEMS
A. Kellner *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 415-419 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16439*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPLICATION OF ARTIFICIAL INTELLIGENCE TO IMPULSIVE ORBITAL TRANSFERS
Rowland E. Burns *In its* Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 433-437 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16442*# Honeywell, Inc., Clearwater, Fla. Space and Strategic Avionics Div.
PROTOTYPE SPACE STATION AUTOMATION SYSTEM DELIVERED AND DEMONSTRATED AT NASA
Roger F. Block *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 447-451 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16443*# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
APPLICATIONS OF EXPERT SYSTEMS FOR SATELLITE AUTONOMY
A. Ciarlo and P. Donzelli (LABEN Space Instrumentation and Systems, Milan, Italy) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 453-457 (For primary document see

N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N88-16464# Brown Univ., Providence, R. I. Center for Dynamical Systems.
STRONG CONVERGENCE AND CONVERGENCE RATES OF APPROXIMATING SOLUTIONS FOR ALGEBRAIC RICCATI EQUATIONS IN HILBERT SPACES
Kazufumi Ito Apr. 1987 23 p
(Grants AF-AFOSR-0303-85; AF-AFOSR-0398-84)
(AD-A186190; LCDS/CCS-87-15; AFOSR-87-1314TR) Avail: NTIS HC A03/MF A01 CSCL 12A

This paper considers the linear quadratic optimal control problem on infinite time interval for linear time-invariant systems define on Hilbert spaces. The optimal control is given by a feedback form in terms of solution pi to the associated algebraic Riccati equation (ARE). A Ritz type approximation is used to obtain a sequence pi sub n of finite dimensional approximations of the solution to ARE. A sufficient condition that shows N sub n converges strongly to pi is obtained. Under this condition, we derive a formula which can be used to obtain rate of convergence of N sub n to pi. We demonstrate and apply the results for the Galerkin approximation for parabolic systems and the averaging approximation for heredity differential systems. Author (GRA)

N88-16465# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
SOME STABILITY RESULTS FOR THE HOPSCOTCH DIFFERENCE METHOD WHEN APPLIED TO CONVECTION-DIFFUSION EQUATIONS
J. G. Verwer May 1987 12 p Presented at the 4th International Seminar on the Numerical Treatment of Differential Equations, Halle, German Democratic Republic, 25-29 May 1987 Submitted for publication
(CWI-NM-R8711; B8717216; ETN-88-91579) Copyright Avail: NTIS HC A03/MF A01

Stability results for the odd-even hopscotch method for convection-diffusion equations where the space discretization is carried out by standard symmetrical and/or one-sided finite differences are presented. A general formulation of the time-stepping scheme and its main computational features are outlined. Linear stability properties of the method in the multidimensional case are discussed. Explicit expressions for the critical time step based on the von Neumann condition are presented. It is shown that in certain cases an increase of diffusion may render the process unstable, in clear contrast to common practice. This phenomenon can occur only in the higher dimensional case. The spectral condition in one space dimension is treated. In accordance with results for the explicit Euler rule, it is concluded that the spectral condition is misleading in the sense that is does not prevent large error growth. ESA

N88-16466# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Operations Research and System Theory.
POLYHEDRAL COMBINATORICS
A. Schrijver Jan. 1987 70 p
(CWI-OS-R8701; B8711093; ETN-88-91580) Copyright Avail: NTIS HC A04/MF A01

Background information on polyhedra and linear programming is given, and total unimodularity, total dual integrality, the matching polytope and generalizations, blocking polyhedra, antiblocking polyhedra, cutting planes, and the complexity of the integer hull are discussed. ESA

N88-16467# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Pure Mathematics.
LIE ALGEBRAIC METHOD IN FILTERING AND IDENTIFICATION
M. Hazewinkel Nov. 1986 20 p
(CWI-PM-R8606; B8709683; ETN-88-91587) Copyright Avail: NTIS HC A03/MF A01

Nonlinear filtering of a stochastic dynamical system $dx = f(x)dt + G(x)dw$, where w is Wiener noise, with observations $dy = h(x)dt + dv$, corrupted by further noise is introduced. Ideas and techniques from Lie algebra theory, stochastics, differential topology, approximation theory, and partial differential equations and relations with quantum theory and stochastic physics are discussed. ESA

N88-16468# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Pure Mathematics.
THE r-RANK OF THE GROUPS OF EXCEPTIONAL LIE TYPE
Arjeh M. Cohen and Gary M. Seitz (Oregon Univ., Eugene.) Dec. 1987 10 p Submitted for publication
(CWI-PM-R8607; B8709684; ETN-88-91588) Copyright Avail: NTIS HC A02/MF A01

A result settling a question raised at the end of Borel and Serre (1953) cf. Borel, 1983 pp. 228 and 708 is proved. Let r be a prime and G a simple algebraic group of exceptional type over an algebraically closed field of characteristic not=r. Let E be an elementary abelian r-subgroup of G of maximal rank. Then rank(E)=Lie rank(G) with the exception of r=2 and G=G2, F4, the adjoint E7, and E8, in which cases rank(E)=lie rank(G)+1. Moreover, E is unique up to conjugacy. ESA

N88-16469# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Pure Mathematics.
A NOTE ON COMPACTIFICATIONS OF PRODUCTS OF SEMIGROUPS
M. Husek and J. deVries Jan. 1987 11 p Submitted for publication
(CWI-PM-R8701; B8709686; ETN-88-91589) Copyright Avail: NTIS HC A03/MF A01

The result of Junghenn generalizing results of De Leeuw and Glicksberg and of Berglund and Milnes, and showing that the almost periodic (AP) compactification of an arbitrary Cartesian product of semitopological semigroups with identity is (canonically) isomorphic to the corresponding product of the AP compactifications of the factors is considered. Junghenn also showed that the analog of this result holds for the strongly almost periodic case. The proofs lean heavily on the characterizations of these compactifications in terms of algebras of functions. An intrinsic proof, using only the objects and morphisms of the categories at hand, is presented. ESA

N88-16470# Technische Hogeschool Twente, Enschede (Netherlands). Facility of Applied Mathematics.
ASYMPTOTIC ERROR BOUNDS FOR POWER APPROXIMATIONS TO MULTINOMIAL TESTS OF FIT
F. C. Drost, W. C. M. Kallenberg, D. S. Moore, and J. Oosterhoff (Vrije Universiteit, Amsterdam, Netherlands) Jul. 1987 24 p
(Memo-640; B8721001; ISSN-0921-1969; ETN-88-91595) Avail: NTIS HC A03/MF A01

The Cressie-Read (1984) class of goodness-of-fit tests is considered. Asymptotic error bounds are derived for two nonlocal approximations, the classical noncentral chi squared approximation and normal approximations to the power of these tests. ESA

N88-16471# Technische Hogeschool Twente, Enschede (Netherlands). Faculty of Applied Mathematics.
A DIRECT APPROACH TO ALMOST DISTURBANCE AND ALMOST INPUT-OUTPUT DECOUPLING
R. Marino, W. Respondek (Polish Academy of Sciences, Wroclaw.), and A. J. vanderSchaft Jul. 1987 51 p
(Memo-641; B8721002; ISSN-0921-1969; ETN-88-91596) Avail: NTIS HC A04/MF A01

A solution to the almost input-output and disturbance decoupling problem based on a canonical form for linear systems, which is obtained in a fully constructive way, is given, together with elementary approximation results. The solution is given in the form of an explicit feedback law, parameterized by a scalar. By letting the scalar go to zero the accuracy of the resulting approximate solution can be improved to any desired degree. ESA

N88-16472# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MATRIX FUNCTIONS IN THE STABILITY OF HIGHER-ORDER NUMERICAL SCHEMES
Julio Cesar Ruiz Claeyssen, Cyro deCarvalhoPatarra, Teresa TsukazandeRuiz, and Marco Tulio Vilhena (Universidade Federale do Rio Grand do Sul, Porto Alegre, Brazil) Jul. 1987 8 p Presented at the 10th Congresso Nacional de Matematica Aplicada e Computacional, Gramado-RS, Brazil, 21-25 Sep. 1987
(INPE-4246-PRE/1119) Avail: NTIS HC A02/MF A01

Matrix functions theory is employed with dynamical solutions for determining sufficient conditions of numerical stability. Examples with equations of parabolic and hyperbolic nature are given. Author

N88-16473# Naval Postgraduate School, Monterey, Calif.
EFFECTS OF UNIFORM TARGET DENSITY ON RANDOM SEARCH M.S. Thesis
Michael J. McNish Sep. 1987 55 p
(AD-A186468) Avail: NTIS HC A04/MF A01 CSCL 12A

This thesis was motivated by a study performed by Commander Submarine Force Pacific (COMSUBPAC) of detection rates for a random search model. COMSUBPAC's study concluded that the probability of nondetection to time t, PND (t), was not of the form exp (gamma t), as believed by many. The target motion model used for that study was a new and interesting model. Therefore this investigation began by analyzing that model. This investigation discovered that the density of targets for COMSUBPAC's motion model was not uniform over the search area, which might lead to a nonexponential form for PND (t). To lend support to the hypothesis that a uniform distribution of target position can lead to an exponential from of PND (t) the target motion was altered to achieve a uniform target density. The same basic target motion was used because of its inherent advantages over other target motion models. GRA

N88-16474# Tennessee Univ., Knoxville. Dept. of Mathematics.
SERIES REPRESENTATIONS OF INFINITELY DIVISIBLE RANDOM VECTORS AND A GENERALIZED SHOT NOISE IN BANACH SPACES Interim Report, Apr. - Jul. 1987
Jan Rosinski 1 Jul. 1987 33 p
(Grant AF AFOSR-0136-87)
(AD-A186502; AFOSR-87-0985TR) Avail: NTIS HC A03/MF A01 CSCL 12A

A generalized shot noise in Banach spaces is defined as the a.s. limit of certain centered sums of dependent random vectors; and, a necessary and sufficient condition for its existence is given. As an immediate application, the LePage-type series representations of infinitely divisible random vectors are obtained. GRA

N88-16475# Army Armament Research and Development Command, Watervliet, N. Y. Weapons Lab.
ADAPTIVE FINITE ELEMENT METHODS FOR PARABOLIC SYSTEMS IN ONE- AND TWO-SPACE DIMENSIONS Final Report
Slimane Adjerid and Joseph E. Flaherty Sep. 1987 39 p
(AD-A186534; ARCCB-TR-87024) Avail: NTIS HC A03/MF A01 CSCL 12A

Adaptive finite element methods are given for solving initial boundary value problems for vector systems of parabolic partial differential equations in one- and two-space dimensions. One-dimension systems are discretized using piecewise linear finite element approximations in space and a backward difference code for stiff ordinary differential systems in time. A spatial error estimate is calculated using piecewise quadratic approximations that employ nodal superconvergence to increase computational efficiency. This error estimate is used to move and refine the finite element mesh in order to equidistribute a measure of the total spatial error and to satisfy a prescribed error tolerance. Ordinary differential equations for the spatial error estimate and the mesh motion are integrated in time using the same backward difference software that is used to determine the finite element solution. Two-dimension systems are discretized using piecewise bilinear finite element approximations in space and backward difference software in time. A spatial error estimate is calculated using piecewise cubic approximations that take advantage of nodal superconvergence, and is used to locally refine a stationary finite element mesh in order to satisfy a prescribed spatial error tolerance. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N88-16476# Naval Research Lab., Washington, D.C.
A STUDY OF THE FREE ENERGY OF THE LENZ-ISING MODEL USING THE CLUSTER VARIATION METHOD OF MORITA Memorandum Report, 1983 - 1986
John J. Condon, Joann Harnden, and Henning Leidecker 6 Oct. 1987 165 p
(AD-A186023; NRL-MR-6080) Avail: NTIS HC A08/MF A01 CSCL 20M

The Cluster Variation Method proposed by Morita is shown to yield a development of the entropy into an alternating series when applied to the Lenz-Ising Model. Truncation of this series to its first N terms gives an N-th order variationally based approximation to the exact statistical behavior of this system. The first four orders of this sequence of approximations have been carried out in this work. Curious behaviors such as complex Curie temperatures have been observed by others and this work shows that such behavior is due to the alternating sign of the terms in the entropy expansion. The effect is large enough to cause a non-physical global minimum to appear on the boundary of the variation space, which is certainly unphysical. A modification of the Cluster Variation Method is effective in suppressing these undesired effects. The (2n+1)-cluster results are then an improvement over those of the (2n+1)-cluster approximation. The (2n)-cluster results are less affected by spurious minima. GRA

N88-16477# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
TEST OF LINEARITY IN GENERAL REGRESSION MODELS
X. R. Chen and P. R. Krishnaiah Dec. 1986 32 p
(Contract F49620-85-C-0008)
(AD-A186036; TR-86-49; AFOSR-87-1093TR) Avail: NTIS HC A03/MF A01 CSCL 12A

Linear regression models are widely used in statistical analysis of experimental and observational data. Usually the linearity of the model is merely an assumption and cannot be taken for granted. In some planned experiments, repeated measurements on the dependent variable Y can be taken while the independent variable X is held fixed. In such cases standard analysis-of-variance technique can be employed to generate a test for linearity. In many applications, however, the independent variable is observed simultaneously with Y. That is to say, X, as well as Y, is a random variable. Under such circumstances the usual method for testing linearity cannot supply. This paper studies this problem in large-sample context. The authors propose a method to test the linearity hypothesis based on a grouping of the data. The critical value of test-statistic is determined so that the test has a prescribed lever of significant alpha asymptotically as the sample size tends to infinity. The consistency of the test is established, and the asymptotic power is calculated when the distance (in some sense) between the true regression function and the space of linear functions tends to zero in some specific rate. GRA

N88-16478# North Carolina Univ., Chapel Hill. Dept. of Statistics.
ESTIMATION AND COMPARISON OF CHANGES IN THE PRESENCE OF INFORMATION RIGHT CENSORING BY MODELING THE CENSORING PROCESS Technical Report, Aug. 1986 - Aug. 1987
Margaret C. Wu and Raymond J. Carroll Mar. 1987 30 p
(Contract F49620-85-C-0144)
(AD-A186320; MMS-1718; AFOSR-87-1073TR) Avail: NTIS HC A03/MF A01 CSCL 12A

In estimating and comparing the rates of change of a continuous variable between two groups, the unweighted averages of individual simple least squares estimates from each group are often used. Under a linear random effects model, when all individuals have completed observations at identical time points these statistics are maximum likelihood estimates for the expected rates of change. However, with censored or missing data, these estimates are no longer efficient when compared to generalized least squares estimates. When, in addition, the right censoring process is dependent upon the individual rates of change (i.e., informative right censoring), the generalized least squares estimates will be biased. Likelihood ratio test for informativeness of the censoring process and maximum likelihood estimates for the expected rates of change and the parameters of the right censoring process are developed under a linear random effect models with a probit model for the right censoring process. In realistic situations, we illustrate that the bias in estimating group rate of change and the reduction of power in comparing group difference could be substantial when strong dependency of the right censoring process on individual rates of change is ignored. Author (GRA)

N88-16479# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Operations Research and System Theory.
SOJOURN TIMES IN THE M/G/1 QUEUE WITH DETERMINISTIC FEEDBACK
J. L. vandenBerg, O. J. Boxma, and W. P. Groenendijk Mar. 1987 12 p Submitted for publication
(CWI-OS-R8708; B8711100; ETN-88-91586) Copyright Avail: NTIS HC A03/MF A01

An M/G/1 queueing model, in which each customer is fed back a fixed number of times is considered. For the case of negative exponentially distributed service times at each visit, the joint distribution of the sojourn times of the consecutive visits is determined. The total sojourn time distribution is also obtained. It can be related to the sojourn time distribution in the M/D/1 queue with processor sharing. For the case of generally distributed service times at each visit, a set of linear equations is derived, from which the mean sojourn times per visit can be calculated. ESA

N88-16480# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Statistics.
NEW DIRECTIONS FOR MULTIVARIATE STATISTICAL COMPUTATION AND DATA ANALYSIS Final Report
William F. Eddy and Stephen E. Fienberg 30 Sep. 1987 8 p
(Contract N00014-84-K-0588)
(AD-A186523) Avail: NTIS HC A02/MF A01 CSCL 12A

This report on new directions for multivariate statistical computation and data analysis contains papers on the following: Papers Submitted to Refereed Journals (not yet published); Papers Published in Refereed Journals; Books (and sections thereof) Published; Invited Presentations at Topical or Scientific/Technical Society Conferences; Contributed Presentation at Topical or Scientific/Technical Society Conferences; Honors/Awards/Prizes; Technical Reports. GRA

N88-16481# Florida State Univ., Tallahassee. Dept. of Statistics.
MEASURING THE DEPENDENCE BETWEEN TWO POINT PROCESSES THROUGH CONFIDENCE INTERVALS FOR THE SECOND ORDER DISTRIBUTION
Hani Doss Sep. 1987 21 p
(Contract F49620-82-K-0007)
(AD-A186735; FSU-Statistics-M767; AFOSR-87-1531TR) Avail: NTIS HC A03/MF A01 CSCL 12A

To assess the dependence structure in a stationary bivariate point process the second-order distribution can be very useful. We prove that the natural estimates of this distribution, based on a realization A1 is less than A2 is less than ... is less than A sub A, B1 is less than B2 is less than ... is less than B sub b are asymptotically normal, and we present a method for constructing approximate confidence intervals for this distribution. GRA

N88-16153# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
THE ENTROPY OF THE LORENTZ MODEL [ZUR ENTROPIE DES LORENZMODELLS]
J. Egger *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 74-76 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N88-16482# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A PROBLEM OF MACHINE REPAIR WITH A VARIABLE NUMBER OF HETEROGENEOUS SERVERS [UM PROBLEMA DE REPARO DE MAQUINAS COM UM NUMERO VARIAVEL DE SERVIDORES DIFERENTES]
Solon Venancio deCarvalho and Paulo Renato deMorais Jul. 1987 11 p In PORTUGUESE; ENGLISH summary Presented at the 8th National Meeting of Production Engineering, Niteroi, Brazil, 6-9 Oct. 1987
(INPE-4245-PRE/1118) Avail: NTIS HC A03/MF A01

A maintenance system is considered consisting of a finite number of identical machines working in parallel at the production facility, a finite number of spare machines, and a repair facility with a finite number of heterogeneous servers. The system is observed at repair completion epochs and/or machine breakdown epochs. At these epochs a decision has to be made about which servers should be activated until the next decision epoch. The cost structure includes lost production costs, repair costs, holding costs, idleness costs, and switch-over costs. The objective is to determine the control policy which minimizes the long-run expected average cost per unit time. Author

N88-16483# Naval Postgraduate School, Monterey, Calif.
RELATING SERVICE DOCTRINE TO SPACE SYSTEM REQUIREMENTS M.S. Thesis
Thomas W. Light Jun. 1987 103 p
(AD-A186620) Avail: NTIS HC A06/MF A01 CSCL 15F

The objective of this thesis is to demonstrate a method of relating doctrine to requirements when considering space concepts. Service contractors, consider the advantages of space, and then relate the advantages of space to the overall context of the proposed space system working within current and future military organizations. To perform these tradeoffs requires a strong foundation in how the services plan to operate in the next conflict; the AirLand Battle and Maritime Strategy provide this strong foundation and will be examined. The Army's Concept Based requirements System (CBRS) relates doctrine to requirements; it will be described as a recommended method for determining joint requirements. To illustrate how CBRS will operate when considering joint space requirements, the concept of a space-based laser designator is explored. GRA

N88-16391*# Alabama Univ., Huntsville. Cognitive Systems Lab.
EXPERT SYSTEMS RELATIONS IN SPACE APPLICATIONS

Michael Brady *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 161-164 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16414*# Alabama Univ., Huntsville. Dept. of Computer Science.
QUALITATIVE MODELS FOR PLANNING: A GENTLE INTRODUCTION
James D. Johannes and James R. Carnes *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 297-302 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16415*# Bendix Field Engineering Corp., Lanham, Md.
OPERATIONAL ASPECTS OF A SPACECRAFT PLANNING/SCHEDULING EXPERT SYSTEM
David R. McLean, Ronald G. Littlefield, and David S. Beyer *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 303-307 (For primary document see N88-16360 08-61)
(Contract NAS5-27772)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16416*# McDonnell-Douglas Corp., St. Louis, Mo. Artificial Intelligence Group.
PLANNING AND SCHEDULING FOR ROBOTIC ASSEMBLY
Barry R. Fox *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 309-313 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16417*# Auburn Univ., Ala. Dept. of Computer Science and Engineering.
PLANNING ACTIVITIES IN SPACE
Kai-Hsiung Chang *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 315-319 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16419*# General Digital Industries, Inc., Huntsville, Ala.
INTERFACING THE EXPERT: CHARACTERISTICS AND REQUIREMENTS FOR THE USER INTERFACE IN EXPERT SYSTEMS
Andrew Potter *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 327-331 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16424*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE INTELLIGENT USER INTERFACE FOR NASA'S ADVANCED INFORMATION MANAGEMENT SYSTEMS Abstract Only
William J. Campbell, Nicholas Short, Jr., Larry H. Rolofs, and Scott L. Wattawa (Science Applications Research, Landover, Md.) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 359-360 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16425*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
AN AI APPROACH FOR SCHEDULING SPACE-STATION PAYLOADS AT KENNEDY SPACE CENTER
D. Castillo (Harris Corp., Melbourne, Fla.), D. Ihrie, M. McDaniel, and R. Tilley *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 361-370 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16426*# Martin Marietta Aerospace, Denver, Colo. Space Systems.
SCHEDULING SPACECRAFT OPERATIONS
Daniel L. Britt, Amy L. Geoffroy, Philip R. Schaefer, and John R. Gohring (Martin Marietta Corp., Englewood, Colo.) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 371-376 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16427*# Computer Sciences Corp., Beltsville, Md. System Sciences Div.
THE RESOURCE ENVELOPE AS A BASIS FOR SPACE STATION MANAGEMENT SYSTEM SCHEDULING
Joy Bush and Anna Critchfield *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 377-381 (For primary document see N88-16360 08-61)
(Contract NAS5-28620)
Avail: NTIS HC A18/MF A01 CSCL 09B

N88-16428*# General Research Corp., Huntsville, Ala.
PROTOTYPE RESUPPLY SCHEDULER
Steve Tanner, Angi Hughes, and Jim Byrd (United Space Boosters, Inc., Huntsville, Ala.) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 383-387 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 09B

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N88-16484# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SOME ASPECTS OF CONTROL FOR SEMILINEAR DISTRIBUTED PARAMETER SYSTEMS
J. A. M. FelippedeSouza Apr. 1987 8 p Presented at the 4th Encontro Regional de Matematica Aplicada e Computacional, Belo Horizonte-MG, 26-28 Mar. 1987
(INPE-4147-PRE/1054) Avail: NTIS HC A02/MF A01

Some aspects of control for nonlinear systems of the type z = Az + Nz + Bu, where A is linear, N is nonlinear, B is linear, z is the state and u is the control. It is assumed that the dynamics of the linear part can be described in terms of a strongly continuous semigroup on an appropriate Banach space (the state space), so that this formulation includes distributed parameter systems and delay systems, as well as lumped parameter systems. Theoretical results in controllability are obtained by using fixed point theorems. It is considered the space X of functions from the interval (0,T) to Z (the possible trajectories of the system). In this setting, some mappings F:X yields X are constructed and the solution of the problem of nonlinear controllability is obtained via the fixed points of such F's. Author

70 PHYSICS (GENERAL)

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics.*

N88-16485# Joint Publications Research Service, Arlington, Va.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: PHYSICS AND MATHEMATICS
29 Oct. 1987 63 p Transl. into ENGLISH from various Russian articles
(JPRS-UPM-87-010) Avail: NTIS HC A04/MF A01

Scientific and technical articles from Russian books and journals are translated and presented. The subject areas covered are: Acoustics; Crystals, Laser Glasses, Semiconductors; Lasers; Nuclear Physics; Optics and Spectroscopy; Plasma Physics; Technical Physics; and Theoretical Physics. For individual titles, see N88-16486 through N88-16509.

N88-16486# Joint Publications Research Service, Arlington, Va.
CHARACTERISTICS OF THERMOOPTICAL SOUND EXCITATION IN METALS Abstract Only **c71**
V. V. Krylov, Ye. P. Ponomarev, and T. V. Shtentsel *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 1 Transl. into ENGLISH from Vestnik Moskovskogo Universiteta, Seriya 3: Fizika, Astronomiya (Moscow, USSR), v. 27, no. 6, Nov. - Dec. 1986 p 43-48 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

Thermooptical sound excitation in a metal is analyzed theoretically, metals being characterized by strong absorption of light and high thermal conductivity. An intensity modulated plane laser beam is assumed to impinge normally on the surface, free boundary, of an elastically isotropic metal body appearing as a half-space relative to the laser beam width. All components of the displacement vector for acoustic waves excited as a result must satisfy the corresponding equation of mechanical motion, which relates components of this vector to components of the stress tensor through density of the metal, as well as the equation of state including thermal effects. The latter equation is linearized, as is also the equation of heat balance completing formulation of the problem. In this approximation the heat balance equation becomes independent of the acoustic variables and can be solved separately from the other two equations. The acoustic part of this boundary value problem of sound excitation by laser radiation is solved with the aid of the corresponding Green tensor. Author

N88-16487# Joint Publications Research Service, Arlington, Va.
APPROXIMATION OF NONCORRELATED REFLECTIONS IN PROBLEM OF SOUND PROPAGATION THROUGH WAVEGUIDE WITH ROUGH BOUNDARY Abstract Only **c71**
A. G. Voronovich *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 2 Transl. into ENGLISH from Akusticheskiy Zhurnal (Moscow, USSR), v. 33, no. 1, Jan. - Feb. 1987 p 19-30 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

The problem of sound propagation through an oceanic waveguide with a rough turbulent water surface as upper boundary is considered, assuming that successive reflections of acoustic waves by that surface are statistically independent. Statistical characteristics of the acoustic field in such a waveguide are calculated, in the approximation of a horizontally homogeneous waveguide medium and a statistically uniform scattering surface. The correlation function for the acoustic field is found as the solution to the applicable integral equation, which reduces to the corresponding equation of radiation transfer. Attenuation and noncoherence as well as nonuniform waves and bottom effect are taken into account. The problem is solved for large scale surface roughness, and the noncoherent component of the correlation function is determined for the case of a point sound source. Author

N88-16488# Joint Publications Research Service, Arlington, Va.
MODE PATTERN OF FIELD GENERATED BY PARAMETRIC RADIATOR IN ACOUSTIC WAVEGUIDE Abstract Only **c71**
V. Yu. Zaytsev, L. A. Ostrovskiy, and A. M. Sumin *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 3 Transl. into ENGLISH from Akusticheskiy Zhurnal (Moscow, USSR), v. 33, no. 1, Jan. - Feb. 1987 p 37-42 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

In connection with the use of parametric radiators for oceanographic research, the field which such a field generates in an acoustic waveguide is analyzed for its mode structure and angular distribution pattern. The sound beam emitted by a directional radiator at an arbitrary angle to the waveguide axis is subject to multiple reflection alternately by the waveguide top and bottom boundaries. The simplest and most practical case is that of a shallow sea, its free surface constituting an acoustically soft boundary and its bed an acoustically hard one. The corresponding nonhomogeneous wave equation is solved for a low frequency field in the far field, where the structure of such a field has been completely developed, for which case the triple integral of the Green function over the volume occupied by the pumping sound beam can be evaluated analytically. The characteristic width of that sound beam is assumed to be much smaller the the vertical mode scale and the phase of vertical low frequency sources is assumed to change much less than 180 deg in any of its vertical sections. A solution is obtained for the general case of an arbitrary entrance angle and for the special case of an entrance angle equal to the inclination angle. Author

N88-16489# Joint Publications Research Service, Arlington, Va.
PERFORMANCE OF LINEAR VERTICAL ANTENNA IN REFRACTIVE MULTIMODE WAVEGUIDE Abstract Only **c71**
Yu. A. Kravtsov and V. M. Kuzkin *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 4-5 Transl. into ENGLISH from Akusticheskiy Zhurnal (Moscow, USSR), v. 33, no. 1, Jan. - Feb. 1987 p 49-54 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

Excitation of normal waves by a linear vertical antenna in a horizontal refractive plane multilayer waveguide such as an oceanic acoustical one is analyzed on the basis of the earlier obtained solution to the problem of an antenna radiating into a refractive multimode waveguide. Ignoring amplitude distortions and including only quadratic phase distortions caused by nonhomogeneity of the medium, the response pattern of such an antenna without compensation is calculated for the simplest case of a uniform amplitude distribution. The response pattern simulated by the envelope of responses discretely calculated corresponding to various glide angles is found not to coincide with the radiation pattern, with the ratio of receiver gain to transmitter gain varying as a nonmonotonic function of the glide angle differently for different modes. This result implies that extending the range of sound propagation through seabed waveguides requires decreasing the fluctuations of the signal to be received by a long antenna. Author

N88-16490# Joint Publications Research Service, Arlington, Va.
ACOUSTIC FIELD IN WAVEGUIDE WITH SLOPING BED Abstract Only **c71**
V. M. Kudryashov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 5 Transl. into ENGLISH from Akusticheskiy Zhurnal (Moscow, USSR), v. 33, no. 1, Jan. - Feb. 1987 p 55-59 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

The acoustic field in a waveguide nonuniformly deep because of a sloping bed is evaluated by a variant of the method of normal modes. The waveguide is treated as a two layer medium with acoustically soft both free surface and bed, the latter having a ladder profile. The corresponding boundary value problem is formulated in an appropriate Cartesian system of coordinates, for a monochromatic sound source and a field satisfying the Helmholtz equation. The system of eigenfunctions in this problem is found to be complete and orthogonal, whereupon the field distribution is calculated in the adiabatic approximation. The results yield a sound propagation anomaly, with scattering of normal waves at steps of the waveguide bed, this anomaly as well as the scattering coefficient being functions of the distance from the sound source. The algorithms were programmed in FORTRAN for a BESM-6 high speed computer. Author

N88-16491# Joint Publications Research Service, Arlington, Va.
DIFFRACTION OF SOUND AT JUNCTION OF TWO WAVEGUIDES Abstract Only **c71**

L. A. Levitskiy *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 6 Transl. into ENGLISH from Akusticheskiy Zhurnal (Moscow, USSR), v. 33, no. 1, Jan. - Feb. 1987 p 66-71 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

Diffraction of sound at the junction of two horizontal identically wide waveguides in an acoustic medium is treated as a boundary contact problem. The resulting sound pressure distribution, which must satisfy the homogeneous Helmholtz equation, is sought for the case of a right hand waveguide with incompressible walls whose flexural vibrations are describable by the Kirchhoff equation for thin plates and a left hand waveguide with walls satisfying the Neumann boundary condition. The excitation coefficients for normal modes in the left hand waveguide and the reflection coefficient at the junction are calculated as functions of the wave number, these coefficients and the radiation pattern being interrelated through the law of energy conservation. Author

N88-16492# Joint Publications Research Service, Arlington, Va.
SCATTERING OF LONGITUDINAL WAVE NORMALLY INCIDENT ON DISCAL CAVITY IN ELASTIC BODY Abstract Only **c71**
S. V. Martynenko *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 9-10 Transl. into ENGLISH from Akusticheskiy Zhurnal (Moscow, USSR), v. 33, no. 1, Jan. - Feb. 1987 p 143-148 Original language document was announced in IAA as A87-36071 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

The problem of the scattering of an elastic monochromatic wave propagating in an infinite isotropic elastic body and encounting an obstacle in the form of an infinitely long thin disk shaped crack is examined. The problem is solved by using the variable separation (Fourier) method. The solution provides a way to calculate fields scattered by common types of plane defects in ultrasonic fault detection. Author

N88-16493# Joint Publications Research Service, Arlington, Va.
EQUATION OF ACOUSTIC AND GRAVITATIONAL WAVES IN STRATIFIED MOVING MEDIUM Abstract Only **c71**
V. Ye. Ostashev *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 10 Transl. into ENGLISH from Akusticheskiy Zhurnal (Moscow, USSR), v. 33, no. 1, Jan. - Feb. 1987 p 150-152 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

A single closed equation is derived to describe both acoustic and gravitational waves in a stratified moving medium, with compressibility of the medium and buoyancy taken into account. This equation, a partial second order differential with respect to time and radial coordinate, follows as an exact corollary from the linearized system of equations of hydrodynamics for such a medium. The coefficients in this equation are functions of the longitudinal coordinate only and, therefore, express the vibrational component of pressure in the form of a Fourier integral with respect to time and the radial coordinate will reduce this equation to a one dimensional ordinary second order differential (Helmholtz) equation. Author

N88-16494# Joint Publications Research Service, Arlington, Va.
METAL-OXIDE SUPERCONDUCTOR BaPbSUB1-xBiSUBxO3: UNUSUAL PROPERTIES AND NEW APPLICATIONS Abstract Only **c76**
A. M. Gabovich and D. P. Moiseyev *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 13-14 Transl. into ENGLISH from Uspekhi Fizicheskikh Nauk (Moscow, USSR), v. 150, no. 4, Dec. 1986 p 599-623 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

Since BaPbO3-BaBiO3 solid solutions with a perovskite structure had been produced, these complex oxides describable by the general formula BaPb1-xBixO3 were studied extensively on account of their superconducting characteristics. Their unique properties include an anomalously low density of electron states on the Fermi surface and a metal to dielectric transition with attendant change of composition, such an oxide in ceramic form constituting a multiple Josephson medium. As a result of theoretical and experimental studies, their crystalline structure and phase transitions were determined. Measurements have revealed a composition dependence of the superconducting transition temperature with that temperature being highest for the oxide with x = 0.25 and dropping below 4.2 K for oxides with x equal to or greater than 0.1 or equal to or greater than 0.35, also the temperature dependence of their electrical resistivity, and the composition dependence of the current density at 77 K and at 300 K peaking for x = 0.2 at each temperature. Author

N88-16495# Joint Publications Research Service, Arlington, Va.
INSTABILITY OF STRONG-ABSORPTION DOMAIN IN SEMICONDUCTOR Abstract Only **c76**
V. A. Stadnik *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 17 Transl. into ENGLISH from Pisma v Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 45, no. 3, 10 Feb. 1987 p 142-144 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

Formation of moving strong absorption domains in a homogeneous semiconductor by impinging laser radiation was demonstrated experimentally, a steep nonlinear increase of the absorption coefficient having been attained by the thermal mechanism. In the experiment ZnSe single crystals were used. Localized and moving domains were examined and recorded under a microscope in the luminescence mode, interband excitation of ZnSe occurring within them. The kinetics of light propagation through a crystal as well as the dependence of the domain thickness and the domain displacement on the intensity of incident light were measured, both having been found to increase as the light intensity increases with an attendant smooth transition from weak to strong pulsations. The dependence of the domain velocity on the light intensity was found to be a bifurcate one, with an unstable lower branch. In a homogeneous crystal, therefore, a domain can move under light of higher than critical intensity. Author

N88-16496# Joint Publications Research Service, Arlington, Va.
EFFECT OF EXTRANEOUS FACTORS ON OPTICAL ONE-PHONON TRANSITIONS IN IMPURITY CENTERS WITH CUBIC SYMMETRY Abstract Only **c76**
V. I. Cherepanov, V. N. Frolov, and A. N. Frolov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 21 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 62, no. 2, Feb. 1987 p 372-380 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

The effect of extraneous factors, a uniform electric or magnetic mechanical stress field, on optical one-phonon and nonphonon transitions in impurity centers with cubic point-group symmetry is evaluated by parameterization of the perturbation theory. This method facilitates calculation of the split of such transitions and the polarization dependence of the intensity of each component. It yields analytical relations which allow comparing calculated intervals between transition components with measured ones. Polarization characteristics of transitions calculated for SrCl2:Yb(2+) and SrF2:Sm(2+) are on this basis compared with measured ones, earlier experiments having already revealed a heating of one-phonon transitions in a magnetic field or under mechanical stress. Author

N88-16497# Joint Publications Research Service, Arlington, Va.
FORMATION OF HIGH-COHERENCE RADIATION IN FREE-RUNNING MODE RUBY LASER FOR PULSE HOLOGRAPHY Abstract Only **c36**
S. D. Nikolayev and I. O. Starobogatov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 22 Transl. into ENGLISH from Optika i

Spektroskopiya (Leningrad, USSR), v. 61, no. 5, Nov. 1986 p 1090-1095 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

Continuous helium-neon and ion lasers are now being used for high quality holography but there are strict constraints as to lens and optical circuit stability. The use of pulsed lasers could eliminate these constraints and allow recording of moving objects. Pulsed free lasing mode ruby lasers are the most promising for large format holography but previously the spatial coherence of the beam has not shown a nonhomogeneous ring structure. Existing free lasing mode ruby lasers have not attained the parameter required for large scale pulse holography. A laser design realized in a 1700 x 350 x 300 cu m unit is described which has improved performance. The volume of the scene which can be holographically recorded was superior to that of an earlier ruby laser device by a factor of 2 and attained 1 cu m. The high level of wavelength stability makes the design useful for the monitoring of large objects by two pulse holographic interferometry methods while the design could be used for the study of microsecond and millisecond processes. Author

N88-16498# Joint Publications Research Service, Arlington, Va.
STIMULATED RAMAN SCATTERING OF PICOSECOND LIGHT PULSES IN LONG DISPERSIVE MEDIUM Abstract Only **c74**
Ye. M. Dianov, L. M. Ivanov, A. Ya. Karasik, P. V. Mamyshev, and A. M. Prokhorov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 28 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 91, no. 6(12), Dec. 1986 p 2031-2038 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

Stimulated Raman scattering of picosecond laser radiation pulses in glass and quartz is considered, of concern being the effect which dispersion of group velocities in a medium with group delay and a wide spectrum of irregular vibrational resonances has on the performance of fiber optics. An experimental study was made using a special picosecond spectrometer with a multichannel analyzer and with a nonlinear crystal as parametric light generator tunable over the 0.74 to 1.9 micron wavelength range by regulation of its temperature. On the basis of recorded spectra and with parameters of the experiment, the interaction length for pumping waves and stimulated Raman scattering waves were calculated as well as its dependence of the Stokes wavelength and the dependence of the increment of scattering gain as well as of the frequency shift of Stokes components on the pumping radiation wavelength. Author

N88-16499# Joint Publications Research Service, Arlington, Va.
STIMULATED MANDELSTAM-BRILLOUIN SCATTERING DURING FORWARD SCATTERING OF LIGHT Abstract Only **c74**
V. D. Kagan *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 29 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 91, no. 6(12), Dec. 1986 p 2001-2007 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

Stimulated Mandelstam-Brillouin scattering of light by sound in an anisotropic forward scattering medium is analyzed theoretically, forward scattering being possible in a birefringent crystal but not in an isotropic medium subject to laws of frequency and wave vector retention. The intensity transfer from incident light to scattered light by sound is described by a system of three wave equations. A comparison with steady stimulated Mandelstam-Brillouin scattering indicates that the region of efficient interaction with attendant intensity transfer shifts in time from the interior of a crystal toward its front face, parametric interaction in the interior becoming overwhelmed by noise as steady state is reached. During the transient period the solution yields a reverse transfer of intensity from the scattered wave to the incident wave at infinity, this reverse transfer being eventually abated by attenuation of the sound. Author

N88-16500# Joint Publications Research Service, Arlington, Va.
COMPARISON OF SENSITIVITY AND PRECISION OF HOLOGRAPHIC AND SPECKLE-INTERFEROMETRY METHODS WITH FOURIER-PLANE RECORDING Abstract Only **c35**
I. S. Klimenko, V. P. Ryabukho, and B. V. Feduleyev *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 32 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 61, no. 5, Nov. 1986 p 1118-1122 Previously announced as X87-74020 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

The two exposure speckle-interferometry method has been supposed to be less sensitive than holographic interferometry methods; however speckle interferometry sensitivity has been found to approach that of holographic interferometry for the measurement of rotational shifts. With Fourier plane recording, both methods have the same sensitivity to rigid shifts and comparable sensitivity to flexible deformation. If there is no lense aberration, both methods have the same sensitivity threshold for objects of the same size as the lense aperture. A study was made of the comparative sensitivity to rigid shifting of the two methods with Fourier plane recording for objects smaller than the lense apertures when the speckle parameters are determined by the object shapes and sizes and the illumination dispersion rather than by lense aperture size. The measurement sensitivity threshold was found to be determined by the size of the field in which the interference pattern forms and this was twice as great for the speckle interferogram which thus had twice as many bands. Author

N88-16501# Joint Publications Research Service, Arlington, Va.
PRESSURE AND TENSION DEPENDENCE OF PHASE SHIFT OF POLARIZATION MODES IN BIREFRINGENT SINGLE-MODE FIBER-OPTIC WAVEGUIDE Abstract Only **c74**
F. A. Shatalov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 34 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 62, no. 2, Feb. 1987 p 472-474 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

The dependence of the phase shift of polarization modes in a birefringent single mode fiber optic waveguide is analyzed theoretically. Axial tension, radial pressure, and hydrostatic pressure are considered each separately as modes of external action on the waveguide, sensitivity of the phase shift to change in any of them being determined by the resulting change in both refractive indexes and in the fiber length. Change in the core geometry and in its contribution to the birefringence is assumed to be negligible. Exact analytical expressions are obtained on this basis for the corresponding sensitivity coefficients, representing sensitivity to change in tension or pressure respectively. These expressions are readily approximated for simple evaluation. Author

N88-16502# Joint Publications Research Service, Arlington, Va.
HIGH-SENSITIVITY RECORDING OF WEAK REFLECTED OR SCATTERED RADIATION BY METHOD OF COHERENT INTRACAVITY RECEPTION WITH YAG:Nd(3+) LASER Abstract Only **c74**
Ye. A. Viktorov, N. M. Galaktionova, A. A. Mak, O. A. Orlov, Ye. V. Tkachenko, and V. I. Ustyugov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 35 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 62, no. 2, Feb. 1987 p 430-436 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

High-sensitivity measurement of small reflection and scattering coefficients by the method of intercavity reception of the weak signal using a single mode continuous wave YAG:Nd(3+) laser with an additional mirror is evaluated, such measurements having already been made with a He-Ne laser. The resonator cavity containing the laser crystal for such a interferometer is formed by a plane mirror and a concave one. The latter mirror passes single frequency radiation to a modulator, through a lens and a filter set. An analysis of this measurement process, taking into account the

Doppler shift which reflection by the moving mirror has produced and disregarding the negligible phase dependence of the laser emission frequency, yields an analytical relation for the instrument sensitivity and the noise immunity threshold of signal power. The role of frequency modulation is examined, this mode of operation ensuring that a sufficiently strong signal enters the noisy photodetector but also degrading the sensitivity measurements.
Author

N88-16503# Joint Publications Research Service, Arlington, Va.
INTERACTION OF ACOUSTIC AND ELECTROMAGNETIC WAVES INVOLVED IN ANOMALOUS SKIN EFFECT Abstract Only **c32**
A. P. Kopasov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 43 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 91, no. 6(12), Dec. 1986 p 2140-2149 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

Action of a transverse electromagnetic wave on an electric conductor carrying a longitudinal acoustic wave with the displacement vector normal to the conductor surface is analyzed, the resulting anomalous skin effect being characterized by emission of electromagnetic radiation at the combination frequencies as a consequence of inevitable attendant nonlinearity. A conductor occupying the positive half space is considered with an acoustic wave of a frequency equal to twice the frequency of the electromagnetic wave. The amplitudes of emitted waves at both combination frequencies are determined from the equation of kinetics for the electron distribution function, assuming specular reflection of electrons by the conductor surface and an isotropic law of electron dispersion. Calculations reveal that an acoustic wave adds to the electromagnetic surface impedance of the conductor, the magnitude of this increment depending linearly on the amplitude of the acoustic wave.
Author

N88-16504# Joint Publications Research Service, Arlington, Va.
EQUATION OF GRAVITATIONAL-GYROSCOPIC WAVES: ANGULAR POTENTIAL AND ITS APPLICATIONS Abstract Only **c02**
S. A. Gabov and Yu. D. Pletner *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 44-45 Transl. into ENGLISH from Zhurnal Vychislitelnoy Matematiki i Matematicheskoy Fiziki (Moscow, USSR), v. 27, no. 1, Jan. 1987 p 102-113 Original language document was announced in IAA as A87-29884 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

A theory is developed for the dynamic logarithmic and angular potentials for the equation of gravitational-gyroscopic waves. The discussion then focuses on the application of these potentials to the derivation of an exact solution to the initial boundary value problem for the above equation, this problem being an analog of the Sedov problem for the Laplace equation. The existence of a large amplitude is demonstrated; the behavior of the solution at large times is examined.
Author

N88-16505# Joint Publications Research Service, Arlington, Va.
NUMERICAL ANALYSIS OF MOTION OF SOLID BODIES IN ATMOSPHERE Abstract Only **c02**
G. M. Lokhov and S. I. Podzorov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 45-46 Transl. into ENGLISH from Zhurnal Vychislitelnoy Matematiki i Matematicheskoy Fiziki (Moscow, USSR), v. 27, no. 2, Feb. 1987 p 272-285 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

Numerical analysis of motion and flight dynamics of a solid body in the atmosphere is considered, asymptotic methods being particularly computer efficient where equations with high frequency terms need to be integrated. In this case the characteristic time for relative motion is assumed to be much shorter than the characteristic time for motion of the center of mass. Assuming further that the body is an ideal solid of revolution with its center of mass on its longitudinal axis of symmetry, that its principal axes of inertia are parallel to the corresponding axes of aerodynamic symmetry, and that its relative motion as well as the motion of its center of mass are motions in a plane, an optimum mathematical model is constructed in the form of systems of nonlinear ordinary differential equations which requires minimum computer time for numerical solution and simulation of flight dynamics on this basis.
Author

N88-16506# Joint Publications Research Service, Arlington, Va.
REMOTE MEASUREMENT OF AEROSOL STREAM VELOCITY WITH CONTINUOUS-WAVE CO2-LASER Abstract Only **c34**
V. I. Bersenev, V. M. Gordiyenko, N. N. Kurochkin, A. V. Priyezzhev, and Yu. Ya. Putivskiy *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 46 Transl. into ENGLISH from Vestnik Moskovskogo Universiteta, Seriya 3: Fizika, Astronomiya (Moscow, USSR), v. 27, no. 6, Nov. - Dec. 1986 p 39-43 Original language document was announced in IAA as A87-41922 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

The laboratory mockup of an automated Doppler lidar for measuring aerosol-stream velocity is described, and results of laboratory measurements are presented. A set of Doppler signal spectra is obtained for various projections of the stream velocity vector on the sounding direction. Results indicate that this CW CO2 laser system can be used to measure wind velocity in the atmosphere at distances of several hundred meters.
Author

N88-16507# Joint Publications Research Service, Arlington, Va.
MODIFICATION OF PROPERTIES OF METALS BY HIGH-POWER ION BEAMS Abstract Only **c26**
A. D. Pogrebnyak, G. Ye. Remnev, S. A. Chistyakov, and A. Ye. Ligachev *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 48 Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedeniy: Fizika (Tomsk, USSR), v. 30, no. 1, Jan. 1987 p 52-65 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

Progress in development of high power ion beams for treatment and forming of metals and alloys through modification of their properties is reviewed analytically. Sources of high power ion beams are described, the basic device being a magnetically isolated diode variously designed and optimized to meet specific requirements. Production of 400 keV ion beams with current up to 4 kA in pulses of typically 60 ns duration, yielding a current density of 150 to 250 A/sq cm, is already feasible. Modification of physicomechanical and chemical properties of the target material by such ion beams is studied and monitored by high sensitive Auger electron spectroscopy and secondary ion mass spectroscopy, also by annihilation of positrons, by Rutherford backscattering of channeled ions, and by Moessbauer spectrum measurements. Modification properties of most concern include wear resistance and corrosion resistance. The effect of ion bombardment on these properties of carbon and alloy steels, aluminum, and tungstenless titanium alloys are compared with that of conventional machining with cutters. A model is proposed which explains this effect of a high power ion beam on a metal in terms of three successive stages.
Author

N88-16508# Joint Publications Research Service, Arlington, Va.
NEW BRANCH OF SOLID-STATE PHYSICS Abstract Only **c76**
V. Ye. Panin *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 49-50 Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedeniy: Fizika (Tomsk, USSR), v. 30, no. 1, Jan. 1987 p 3-8 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

Research in solid-state physics branched out in a new direction, concerning highly excited states in crystals, upon publication of the article, Atom Vacancy States in Crystals. Perturbation theory

and translational symmetry not being applicable here, new concepts had to be developed. Any distortion of the crystal structure must be treated not simply as a defect but as an allowed state genetically latent within the electron energy spectrum of a crystal. Five articles on the subject have been published: Highly Excited States in Crystals; Spectrum of Excited States and Vortical Mechanical Field in Deformed Crystal; Modification of Properties of Metals by High Power Ion Beams; Anomalous Hall Effect in Disordered Ferromagnetic Alloys of Transition Metals; and Restructurization of Atomic Condensed State Under Strong External Influencing Action. These articles are briefly discussed. Author

N88-16509# Joint Publications Research Service, Arlington, Va.
EXISTENCE OF ABSOLUTELY CLOSED UNIVERSE Abstract Only **c77**
M. A. Markov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 54 Transl. into ENGLISH from Pisma v Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 45, no. 2, 25 Jan. 1987 p 61-64 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

The mass within the spherical layer by which a closed isotropic Universe expands to its maximum radius is calculated according to classical mechanics and the Landau-Lifshits field theory. This mass is found to be universal and independent of the Universe's bare mass, which satisfies the pertinent general fundamental theorem. The imprecision of determining the maximum radius and thus also the volume of that spherical layer is accounted for. An analysis of the results in the light of concepts such as grey holes, black holes of the second kind, and maximum clusters leads to the conclusions that the Universe cannot be absolutely closed and cannot evolve from nothing, also that a black hole of second kind can be stable and have a mass of the order of a maximum mass but cannot evolve from simple collapse of stars. Author

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environmental Pollution.*

N88-16510*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SHOCK STRUCTURE AND NOISE OF SUPERSONIC JETS IN SIMULATED FLIGHT TO MACH 0.4
Thomas D. Norum and John G. Shearin Feb. 1988 187 p (NASA-TP-2785; L-16341; NAS 1.60:2785) Avail: NTIS HC A09/MF A01 CSCL 20A

Measured jet plume static pressure distributions and far-field acoustic spectra are presented for underexpanded jets in simulated flight up to a Mach number of 0.4. A gradual stretching of the downstream shock cells is found as the Mach number increases, with no perceptible change in the shock strength. There appears to be little effect of flight on the broadband shock noise amplitudes, and the small changes in its peak frequency for the same emission angle are correlated with the slightly longer shock cells in flight. The larger changes in the broadband peak frequency found at the same angle in wind tunnel coordinates are attributable to convection. Jet mixing noise production decreases significantly with increasing flight speed. Author

N88-16511# Naval Underwater Systems Center, New London, Conn.
FOR3D: A COMPUTER MODEL FOR SOLVING THE LSS (LEE-SAAD-SCHULTZ) THREE-DIMENSIONAL, WIDE ANGLE WAVE EQUATION
George Botseas, Ding Lee, and David King 14 Aug. 1987 76 p
(AD-A186649; NUSC-TR-7943) Avail: NTIS HC A05/MF A01 CSCL 20A

A computer model is developed for implementing the Lee-Saad-Schultz (LSS) method for solving the LSS Three-dimensional wide angle wave equation. The model is designed to predict propagation loss in range-, depth-, and azimuthal-dependent ocean environments. Computational speed is favorable since the Lee-Saad-Schultz method requires only solving two tri-diagonal systems of equations for each step marched forward in range. A test problem is included for demonstrating accuracy and the capabilities of the model. The model is written in Fortran for a VAX 11/780 computer. GRA

N88-16053# Northrop Corp., Hawthorne, Calif. Electronics Div.
EVALUATION OF VIBRATION SPECIFICATIONS FOR ACOUSTIC ENVIRONMENTS
L. T. Nguyen and G. J. Zeronian *In* Shock and Vibration Information Center The Shock and Vibration Bulletin. Part 3: Isolation and Damping, Vibration Test Criteria and Vibration Analysis and Test Jan. 1987 p 155-158 (For primary document see N88-16040 08-39)
Avail: NTIS HC A10/MF A01 CSCL 20A

N88-16486# Joint Publications Research Service, Arlington, Va.
CHARACTERISTICS OF THERMOOPTICAL SOUND EXCITATION IN METALS Abstract Only
V. V. Krylov, Ye. P. Ponomarev, and T. V. Shtentsel *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 1 Transl. into ENGLISH from Vestnik Moskovskogo Universiteta, Seriya 3: Fizika, Astronomiya (Moscow, USSR), v. 27, no. 6, Nov. - Dec. 1986 p 43-48 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

N88-16487# Joint Publications Research Service, Arlington, Va.
APPROXIMATION OF NONCORRELATED REFLECTIONS IN PROBLEM OF SOUND PROPAGATION THROUGH WAVEGUIDE WITH ROUGH BOUNDARY Abstract Only
A. G. Voronovich *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 2 Transl. into ENGLISH from Akusticheskiy Zhurnal (Moscow, USSR), v. 33, no. 1, Jan. - Feb. 1987 p 19-30 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

N88-16488# Joint Publications Research Service, Arlington, Va.
MODE PATTERN OF FIELD GENERATED BY PARAMETRIC RADIATOR IN ACOUSTIC WAVEGUIDE Abstract Only
V. Yu. Zaytsev, L. A. Ostrovskiy, and A. M. Sumin *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 3 Transl. into ENGLISH from Akusticheskiy Zhurnal (Moscow, USSR), v. 33, no. 1, Jan. - Feb. 1987 p 37-42 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

N88-16489# Joint Publications Research Service, Arlington, Va.
PERFORMANCE OF LINEAR VERTICAL ANTENNA IN REFRACTIVE MULTIMODE WAVEGUIDE Abstract Only
Yu. A. Kravtsov and V. M. Kuzkin *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 4-5 Transl. into ENGLISH from Akusticheskiy Zhurnal (Moscow, USSR), v. 33, no. 1, Jan. - Feb. 1987 p 49-54 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

N88-16490# Joint Publications Research Service, Arlington, Va.
ACOUSTIC FIELD IN WAVEGUIDE WITH SLOPING BED Abstract Only
V. M. Kudryashov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 5 Transl. into ENGLISH from Akusticheskiy Zhurnal (Moscow, USSR), v. 33, no. 1, Jan. - Feb. 1987 p 55-59 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

N88-16491# Joint Publications Research Service, Arlington, Va.
DIFFRACTION OF SOUND AT JUNCTION OF TWO WAVEGUIDES Abstract Only
L. A. Levitskiy *In its* JPRS Report: Science and Technology.

USSR: Physics and Mathematics 29 Oct. 1987 p 6 Transl. into ENGLISH from Akusticheskiy Zhurnal (Moscow, USSR), v. 33, no. 1, Jan. - Feb. 1987 p 66-71 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

N88-16492# Joint Publications Research Service, Arlington, Va.
SCATTERING OF LONGITUDINAL WAVE NORMALLY INCIDENT ON DISCAL CAVITY IN ELASTIC BODY Abstract Only
S. V. Martynenko *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 9-10 Transl. into ENGLISH from Akusticheskiy Zhurnal (Moscow, USSR), v. 33, no. 1, Jan. - Feb. 1987 p 143-148 Original language document was announced in IAA as A87-36071 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

N88-16493# Joint Publications Research Service, Arlington, Va.
EQUATION OF ACOUSTIC AND GRAVITATIONAL WAVES IN STRATIFIED MOVING MEDIUM Abstract Only
V. Ye. Ostashev *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 10 Transl. into ENGLISH from Akusticheskiy Zhurnal (Moscow, USSR), v. 33, no. 1, Jan. - Feb. 1987 p 150-152 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

N88-16512# California Univ., Berkeley. Lawrence Berkeley Lab.
NEAR THRESHOLD BEHAVIOR OF PHOTOELECTRON SATELLITE INTENSITIES
D. A. Shirley, U. Becker, P. A. Heimann, and B. Langer Sep. 1987 14 p Presented at the 14th International Conference on X-ray and Inner-Shell Processes, Paris, France, 14 Sep. 1987 Prepared in cooperation with Wuerzburg Univ., Federal Republic of Germany; Technische Univ., Garching, Federal Republic of Germany; and Technische Univ., Berlin, Federal Republic of Germany
(Contract DE-AC03-76SF-00098)
(DE88-002231; LBL-23989; CONF-8709135-4) Avail: NTIS HC A03/MF A01

The historical background and understanding of photoelectron satellite peaks is reviewed, using He(n), Ne(1s), Ne(2p), Ar(1s), and Ar(3s) as case studies. Threshold studies are emphasized. The classification of electron correlation effects as either intrinsic or dynamic is recommended. DOE

N88-16513# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A GENERALIZED DESCRIPTION OF THE ANOMALOUS DOPPLER RESONANCE AND THE STABILIZING ROLE OF ION DYNAMICS
R. O. Dendy, C. N. Lashmore-Davies (United Kingdom Atomic Energy Authority, Culham, England), and Antonio Montes Sep. 1987 6 p Presented at the 13th European Conference on Controlled Fusion and Plasma Heating, Schliersee, Fed. Republic of Germany, 1986 Submitted for publication
(INPE-4384-PRE/1204) Avail: NTIS HC A02/MF A01

The anomalous Doppler effect is of interest as a fundamental limit on superthermal tail formations in tokamak plasmas, and as a probable explanation of the relaxation oscillations seen in the soft X-ray signal from Ohmic plasmas and in association with lower hybrid current drive. In this application, the divergence of fast-electron motion from the parallel direction as the anomalous Doppler instability proceeds is responsible for the shift in the predominant direction of electron bremsstrahlung, which follows the fast-electron motion. A number of studies have considered such quasilinear development of the instability. The linear instability remains of interest, however, and this aspect of the phenomenon is examined. Author

N88-16514# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
RESONANCE EXCITATION IN GAMMA GAMMA COLLISIONS AT LEP200
F. C. Erne Jan. 1987 19 p Presented at the ECFA Workshop LEP200, Aachen, Fedral Republic of Germany, 29 Sep. - 1 Oct. 1986
(NIKHEF-H/87-3; B8719016; ETN-88-91598) Avail: NTIS HC A03/MF A01

Cross sections and rates for observing charmonium and heavier states in exclusive channels are estimated for LEP200. A resonance discovery plot is presented. Searches for excited electrons are discussed. ESA

N88-16515# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
TWO-PHOTON EXCLUSIVE MESON PRODUCTION AT LARGE ANGLES
S. J. Brodsky, F. C. Erne, P. H. Damgaard, and P. M. Zerwas (Technische Hochschule, Aachen, West Germany) Jan. 1987 14 p Presented at the ECFA Workshop LEP200, Aachen, Federal Republic of Germany, 29 Sep. - 1 Oct. 1986
(NIKHEF-H/87-4; B8715856; ETN-88-91599) Avail: NTIS HC A03/MF A01

Quantum chromodynamic predictions for the production of meson pairs at large angles in gamma gamma collisions are summarized. Production rates for LEP200 energies are investigated. ESA

N88-16516# Nebraska Univ., Lincoln. Dept. of Physics and Astronomy.
HYPERSPHERICAL COORDINATE THEORY OF TWO-ELECTRON PROCESSES: FUTURE PLANS Technical Progress Report
J. Macek and A. F. Starace 1987 11 p
(Contract DE-FG02-85ER-13440)
(DE87-010653; DOE/ER-13440/1) Avail: NTIS HC A03/MF A01

The main focus is the theoretical study of the effect of electron correlations on atomic collision processes. The theoretical approaches taken are primarily those based on the hyperspherical coordinate description of many body systems. A major aim of the project is to lay the ground work for state-of-the-art calculations of collision cross sections using hyperspherical coordinate methods. In addition, applications are made to specific atomic collision processes relevant to energy-related research in those cases where a hyperspherical coordinate point of view can significantly contribute to understanding the underlying physical mechanisms. DOE

N88-16517# Sandia National Labs., Albuquerque, N. Mex. Test Planning and Diagnostics Div.
STATUS OF CROSS SECTION DATA FOR PHOTON SCATTERING BY ATOMS
Lynn Kissel and R. H. Pratt (Pittsburgh Univ., Pa.) 1987 5 p Presented at the Joint Meeting of the American Nuclear Society and the Atomic Industrial Forum, Los Angeles, Calif., 15 Nov. 1987
(Contract DE-AC04-76DP-00789)
(DE87-011281; SAND-87-1682C; CONF-871101-13) Avail: NTIS HC A02/MF A01

In this discussion of photon scattering from atoms, we distinguish between elastic and inelastic scattering, and we restrict our attention to the scattering of one photon from an isolated atom. We do not consider the absorption of that photon (atomic photoeffect), or multi-photon processes (as in an intense laser beam), or processes in which additional particles are created (as in photon splitting or creation of electron-positron pairs), or effects of atomic environments (as in solids or plasmas). We also do not

consider two-step processes involving substantial time delays, which can be understood in terms of absorption and subsequent re-emission (fluorescence). DOE

N88-16518# Lawrence Livermore National Lab., Calif.
NEW NUCLEAR STRUCTURE CALCULATIONS AND THE ASTROPHYSICAL r-PROCESS
W. Michael Howard, Peter Moeller (Lund Inst. of Tech., Sweden), Grant J. Mathews, and Bradley S. Meyer Sep. 1987 18 p Presented at the Symposium on the Origin and Distribution of Elements, New Orleans, La., 31 Aug. 1987
(Contract W-7405-eng-48)
(DE88-000979; UCRL-97444; CONF-8708165-3) Avail: NTIS HC A03/MF A01

Recent developments in nuclear-structure calculations used to calculate the nuclear properties of neutron-rich heavy elements can have a dramatic effect on astrophysical r-process calculations. In particular, in the context of the macroscopic-microscopic method, studies of the effect of the finite range of the nuclear force on the surface energy, the shape dependence of the Wigner term, new shape degrees of freedom near scission, and improved single particle potentials for neutron-rich heavy elements have led to improved calculations of the properties of heavy elements. We will discuss preliminary applications of these new models to nuclei of interest in the astrophysical r-process and the implications for nuclear cosmochronology and the existence of superheavy elements in nature. DOE

N88-16519# Pennsylvania Univ., Philadelphia.
FACTORS GOVERNING LIGHT DRIVEN ELECTRON AND PROTON TRANSLOCATION IN PROTEINS ACROSS MEMBRANES Technical Report, Oct. 1987 - Oct. 1988
1988 4 p
(Contract DE-FG02-86ER-13476)
(DE88-002716; DOE/ER-13476/3) Avail: NTIS HC A02/MF A01

Progress in development of photosynthetic membranes using phospholipid-reaction center dispersions is described. DOE

N88-16520# Argonne National Lab., Ill.
DEPTH OF ORIGIN OF SPUTTERED ATOMS: EXPERIMENTAL AND THEORETICAL STUDY OF Cu/Ru(0001)
J. W. Burnett, J. P. Biersack, D. M. Gruen, B. Joergensen, A. R. Krauss, M. J. Pellin, E. L. Schweitzer, J. T. Yates, Jr., and C. E. Young 1987 16 p Presented at the 34th National Vacuum Symposium and Topical Conference, Anaheim, Calif., 2 Nov. 1987 Prepared in cooperation with Pittsburgh Univ., Pa. and Hahn-Meitner-Inst. fuer Kernforschung Berlin G.m.b.H., Fed. Republic of Germany
(Contract W-31-109-eng-38)
(DE88-002848; CONF-871125-14) Avail: NTIS HC A03/MF A01

The depth of origin of sputtered atoms is a subject of considerable interest. The surface sensitivity of analytical techniques such as Secondary Ion Mass Spectrometry (SIMS) and Surface Analysis by Resonance Ionization of Sputtered Atoms (SARISA), and the sputtering properties of strongly segregating alloy systems, are critically dependent on the sputtering depth of origin. A significant discrepancy exists between the predictions of the Sigmund theory and computer sputtering models; in general, the computer models predict a much shallower depth of origin. The existing experimental evidence suggests that most of the sputtered atoms originate in the topmost atomic layer, but until recently, the results have not been definitive. We have experimentally determined the depth of origin of atoms sputtered from surfaces consisting of Cu films of less than two monolayers on a Ru(0001) substrate. The Cu/Ru target was statically sputtered using 3.6 keV Ar^+. The sputtered neutrals were non-resonantly laser ionized and detected using SARISA. The Cu/Ru sputtering yield ratio and the suppression of the Ru sputtering yield were determined for various Cu coverages. The results indicate that the majority of the sputtered atoms originate in the topmost atomic layer. The Cu/Ru system is also modeled using a modified Transport of Ions in Matter (TRIM) code. It was found that TRIM C does not correctly treat the first atomic layer, resulting in a serious underestimate of the number of sputtered atoms which originate in this layer. The corrected version adequately describes the results, predicting that for the experimental conditions roughly two-thirds of the sputtered atoms originate in the first atomic layer. These results are significantly greater than the Sigmund theory estimate of greater than 40 percent. DOE

N88-16521# Argonne National Lab., Ill.
EFFECTS OF ENERGY, DISTANCE AND ORIENTATION ON ELECTRON TRANSFER RATES STUDIED BY PULSE RADIOLYSIS IN ORGANIC MEDIA
J. R. Miller 1987 6 p Presented at the 8th International Congress of Radiation Research, Edinburgh, United Kingdom, 19 Jul. 1987
(Contract W-31-109-eng-38)
(DE88-002906; CONF-870701-9) Avail: NTIS HC A02/MF A01

In the past few years the methods of radiation chemistry in organic media have made an enormous change in how we view electron transfer processes, as these media have proved the most useful for studying long distance electron transfer between molecules. This paper briefly summarizes a few of the aspects of this area and discusses some of the attributes and limitations of radiation tehniques, particularly pulse radiolysis, in organic solvents. DOE

N88-16522# Rice Univ., Houston, Tex.
BASIC PHYSICS PROGRAM FOR A LOW ENERGY ANTIPROTON SOURCE IN NORTH AMERICA
B. E. Bonner and M. M. Nieto 1987 35 p Presented at the 2nd Review and Planning Workshop on Antiproton Science and Technology, Santa Monica, Calif., 6 Oct. 1987 Prepared in cooperation with Los Alamos National Lab., N. Mex.
(Contract W-7405-eng-36)
(DE88-003148; LA-UR-87-3980; CONF-8710125-4) Avail: NTIS HC A03/MF A01

We summarize much of the important science that could be learned at a North American low energy antiproton source. It is striking that there is such a diverse and multidisciplinary program that would be amenable to exploration. Spanning the range from high energy particle physics to nuclear physics, atomic physics, and condensed matter physics, the program promises to offer many new insights into these disparate branches of science. It is abundantly clear that the scientific case for rapidly proceeding towards such a capability in North America is both alluring and strong. DOE

N88-16523# California Univ., Santa Barbara. Dept. of Electrical and Computer Engineering.
ELECTRON ACCELERATION BY LASER FIELDS IN A GAS Technical Progress Report
J. R. Fontana 1 Dec. 1987 9 p
(Contract DE-AS03-84ER-40136)
(DE88-003337; DOE/ER-40136/T6) Avail: NTIS HC A02/MF A01

Alternative media are considered for inverse Cherenkov interactions, with refractive indices given for several neutral gases. Breakdown considerations are taken into account as well as elastic collisions. Properties of ionized gases are also discussed as they relate to the usefulness of plasmas as accelerator media. The planning for inverse Cherenkov interaction experiments at a CO2 laser, 50 MeV electron linac test facility is being carried out. DOE

N88-16524# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
GROUP 2A METASTABLE COLLISION COMPLEXES: SPECTROSCOPY AND BEHAVIOR IN INTENSE RADIATION FIELDS Final Report
J. Cooper and J. Coutts 18 Sep. 1987 67 p
(Grant AF-AFOSR-0027-84)
(AD-A186737; AFOSR-87-1374TR) Avail: NTIS HC A04/MF A01 CSCL 07B

This report describes work addressing the problems of collisional induced oscillator strength and energy transfer from metastable states in Group IIA alkaline earth metal atoms. The quenching of CA 3PJ states when perturbed by rare was atom collisions is investigated and such quenching is found to be negligable. The CA 1D2 state, however shows considerable collisional induced effects. Calculations have been performed which show that collision cross-sections for transfer of electronic excitation may be switched from the low values typically associated with off-resonant processes to the high values associated with resonant processes by using a strong laser to bring dressed states in one atom in and out of resonance with bare states in another atom. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N88-16525# Oak Ridge National Lab., Tenn.

DESIGN CONSIDERATIONS FOR A NEGATIVE ION SOURCE FOR DC OPERATION OF HIGH-POWER, MULTI-MEGAELECTRON-VOLT NEUTRAL BEAMS

C. C. Tsai, W. L. Stirling, M. A. Akerman, W. R. Becraft, W. K. Dagenhart, H. H. Haselton, P. M. Ryan, D. E. Schechter, and J. H. Whealton 1987 6 p Presented at the 12th Symposium on Fusion Engineering, Monterey, Calif., 12 Oct. 1987

(Contract DE-AC05-84OR-21400)

(DE88-002692; CONF-871007-60) Avail: NTIS HC A02

A dc negative hydrogen and/or deuterium ion source is needed to produce high-power, high-energy neutral beams for alpha diagnostics and current drive applications in fusion devices. The favorable beam particle energy for such applications extends to 1.5 MeV/amu. Continuous-wave (cw) radiofrequency quadrupole (RFQ) accelerators have been proposed to accelerate negative ions efficiently to this energy range. In this paper, the desired beam properties for ion beams injected into cw RFQ accelerators are summarized. A number of candidate ion sources being developed at Culham, JAERI, LBL, and ORNL may prove useful for these applications. The properties of the Volume Ionization with Transverse Extraction (VITEX) ion sources being developed at ORNL are presented. Scaling such a dc ion source to produce ampere beams is discussed. DOE

74 OPTICS

Includes light phenomena; and optical devices.

For lasers see *36 Lasers and Masers.*

N88-16526*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

BE URSAE MAJORIS: A DETACHED BINARY WITH A UNIQUE REPROCESSING SPECTRUM

Donald H. Ferguson, James Liebert, Roc Cutri, Richard F. Green, S. P. Willner, Joao E. Steiner, and Susan Tokarz (Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.) Sep. 1987 14 p Previously announced in IAA as A87-39310 Submitted for publication

(Grants NAG5-38; NSF AST-80-24324; NSF AST-85-14778)

(NASA-CR-182419; NAS 1.26:182419; INPE-4348-PRE/1184)

Avail: NTIS HC A03/MF A01 CSCL 20F

New infrared photometry, optical and UV spectrophotometry, and a photographic ephemeris are presented for the detached binary BE UMa. Results show the primary to be a DO white dwarf with an effective temperature of 80,000 + or - 15,000 K and a mass of 0.6 + or - 0.1 solar masses. No evidence is found for variability of the primary. The main sequence secondary star is shown to be of early M spectral type, with a formal range of M1 to M5 being possible. A reflection effect in reprocessed line and continuum radiation is produced by EUV radiation from the primary incident on the secondary atmosphere. It is suggested that the temperature of the reprocessed component of the secondary's atmosphere is in the 5000 to 8500 K range, and that emission lines of decreasing ionization form deeper in the irradiated envelope. Relatively narrow He II and high excitation metal lines are formed from recombination and continuum fluorescence processes. E.R.

N88-16527# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

DIGITAL IMAGE PROCESSING [PROCESSAMENTO DIGITAL DE IMAGENS]

Junior Barrera Feb. 1987 71 p In PORTUGUESE; ENGLISH summary

(INPE-4131-TDL/264) Avail: NTIS HC A04/MF A01

The emergency of a body of knowledge is presented, which is structured on solid mathematical concepts and compatible with the physical restrictions: the subject, image processing. It shows a revision, under conceptual mathematical optics, of the main techniques used in image processing and emphasizes the organic character that these techniques give to the subject. It covers image concept, formation, digitalization, modeling, restoration, analysis, and reconstruction. Author

N88-16528# Helsinki Univ. of Technology, Espoo (Finland). Electromagnetics Lab.

TRANSVERSELY ANISOTROPIC CURVED OPTICAL FIBRES: VARIATIONAL ANALYSIS OF A NONSTANDARD EIGENPROBLEM

M. I. Oksanen and I. V. Lindell Jul. 1987 34 p

(PB88-112966; Rept-15; ISBN-951-754-240-2) Avail: NTIS HC A03/MF A01 CSCL 20F

A new variational functional is introduced for the analysis of curved open and closed waveguides. The theory is based on variational principle for nonstandard eigenvalue problems, recently applied for straight anisotropic fibers. The present method does not set any restrictions to the shape of the waveguide or to the radius of the bend. The dielectric function can be homogeneous or nonhomogeneous with transverse and/or longitudinal anisotropy. As an example of the method a curved isotropic and anisotropic single mode fiber with two different kinds of anisotropy models are studied. The analysis includes field distributions, changes in the dispersion curves due to reformed geometry, and birefringence properties in the curved anisotropic fibers. GRA

N88-16529# Argonne National Lab., Ill.

CRYSTAL DIFFRACTION LENSES FOR IMAGING GAMMA-RAY TELESCOPE

R. K. Smither Jun. 1987 6 p Presented at the 13th Texas Symposium on Relativistic Astrophysics, Chicago, Ill., 25 Dec. 1986

(Contract W-31-109-eng-38)

(DE88-003084; CONF-8612112-1) Avail: NTIS HC A02/MF A01

Recent developments in the design of crystal diffraction lenses has made it possible to build a gamma-ray telescope that produces a real image of a distant object. This can be done both with surface diffraction optics and with transmission diffraction optics. The mathematical solution to both cases is the same but they differ in the way the crystals are cut and bent. Until recently, there was no solution for the transmission case. It is this last case that will be highlighted in this paper, because it is new and because it makes much more efficient use of the crystal material when high energy photons (greater than 50 keV) are being focused. DOE

N88-15796*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OPTICAL MEASUREMENT SYSTEMS

Daniel J. Lesco *In its* Aeropropulsion '87. Session 4: Instrumentation and Controls Research Nov. 1987 17 p

(For primary document see N88-15794 08-07)
Avail: NTIS HC A05/MF A01 CSCL 09C

N88-15798*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FIBER OPTICS FOR CONTROLS
Gary T. Seng *In its* Aeropropulsion '87. Session 4: Instrumentation and Controls Research Nov. 1987 14 p (For primary document see N88-15794 08-07)
Avail: NTIS HC A05/MF A01 CSCL 20F

N88-16167# Ludwig-Maximilians-Universitaet, Munich (West Germany). Inst. fuer Meteorologie.
TELESCOPE DESIGN FOR MICHELSON INTERFEROMETER FOR PASSIVE ATMOSPHERIC SOUNDING (MIPAS) B [TELESKOPDESIGN FUER MIPAS-B]
Chr. Fritzche *In its* Research Work at the Meteorological Institute of the University of Munich (Federal Republic of Germany) Mar. 1987 p 144-147 In GERMAN (For primary document see N88-16141 08-42)
Avail: NTIS HC A11/MF A01

N88-16255# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
PRONAOS: A SUBMILLIMETER FACILITY
G. Serra, G. Bellaiche, P. Encrenaz, and J. M. Lamarre (Centre National de la Recherche Scientifique, Verrieres-Le Buisson, France) *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 333-336 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

N88-16498# Joint Publications Research Service, Arlington, Va.
STIMULATED RAMAN SCATTERING OF PICOSECOND LIGHT PULSES IN LONG DISPERSIVE MEDIUM Abstract Only
Ye. M. Dianov, L. M. Ivanov, A. Ya. Karasik, P. V. Mamyshev, and A. M. Prokhorov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 28 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 91, no. 6(12), Dec. 1986 p 2031-2038 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

N88-16499# Joint Publications Research Service, Arlington, Va.
STIMULATED MANDELSTAM-BRILLOUIN SCATTERING DURING FORWARD SCATTERING OF LIGHT Abstract Only
V. D. Kagan *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 29 Transl. into ENGLISH from Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 91, no. 6(12), Dec. 1986 p 2001-2007 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

N88-16501# Joint Publications Research Service, Arlington, Va.
PRESSURE AND TENSION DEPENDENCE OF PHASE SHIFT OF POLARIZATION MODES IN BIREFRINGENT SINGLE-MODE FIBER-OPTIC WAVEGUIDE Abstract Only
F. A. Shatalov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 34 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 62, no. 2, Feb. 1987 p 472-474 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

N88-16502# Joint Publications Research Service, Arlington, Va.
HIGH-SENSITIVITY RECORDING OF WEAK REFLECTED OR SCATTERED RADIATION BY METHOD OF COHERENT INTRACAVITY RECEPTION WITH YAG:Nd(3+) LASER Abstract Only
Ye. A. Viktorov, N. M. Galaktionova, A. A. Mak, O. A. Orlov, Ye. V. Tkachenko, and V. I. Ustyugov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 35 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 62, no. 2, Feb. 1987 p 430-436 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N88-16530# Texas Univ., Austin. Inst. for Fusion Studies.
RELATION OF WAVE ENERGY AND MOMENTUM WITH THE PLASMA DISPERSION RELATION IN AN INHOMOGENEOUS PLASMA
H. L. Berk and D. Pfirsch Oct. 1987 30 p
(Contract DE-FG05-80ET-53088)
(DE88-002305; DOE/ET-53088/302; IFSR-302) Avail: NTIS HC A03/MF A01

The expressions for wave energy and angular momentum commonly used in homogeneous and near homogeneous media, is generalized to inhomogeneous media governed by a nonlocal conductivity tensor. The expression for wave energy applies to linear excitations in an arbitrary three-dimensional equilibrium, while the expression for angular momentum applies to linear excitations of azimuthally symmetric equilibria. The wave energy is interpreted as the energy transferred from linear external sources to the plasma if there is no dissipation. With dissipation, such a simple interpretation is lacking as energy is also thermally absorbed. However, for azimuthally symmetric equilibria the expression for the wave energy in a frame rotating with a frequency omega, E sub wave - omega L sub wave I, where L sub wave is the wave angular momentum defined in the text and I the azimuthal wavenumber, can be unambiguously separated from thermal energy, and is closely related the real part of a dispersion relation for marginal stability. The imaginary part of the dispersion is closely related to the energy input into a system. Another useful quantity discussed is the impedance form, which can be used for three-dimensional equilibrium without an ignorable coordinate and the expression is closely related to the wave impedance used in antenna theory. Applications to stability theory is also discussed.
DOE

N88-16531# Los Alamos National Lab., N. Mex.
BIDIRECTIONAL ELECTRON HEAT FLUX EVENTS IN SPACE
S. J. Bame and J. T. Gosling 1986 22 p Presented at the Tokyo Plasma Workshop, Tokyo, Japan, 1 Nov. 1986
(Contract W-7405-eng-36)
(DE88-001791; LA-UR-87-3519; CONF-8611203-1) Avail: NTIS HC A03/MF A01

In this paper we discuss a number of space plasma phenomena which have been illuminated by a powerful diagnostic tool provided by tracing heat flux carried by the solar wind. Measurements of this flow of heat energy from the Sun and other hot plasma regions have been employed to increase our understanding of the solar wind interaction with solar system objects. Similarly, anomalies in the heat flux have helped to explain unusual plasma entities which are sometimes found in the interplanetary solar wind. The heat flux is principally carried by the solar wind electrons, since they are much more mobile than the ions. The electrons conduct heat outward from the hot solar corona and in a sense they constitute test particles that trace out the various plasma structures found in the solar wind and in the vicinities of bodies immersed in the interplanetary plasma flow. In the following sections we begin by discussing the electron heat flux which flows outward from the solar corona. This flux is ordinarily found flowing in one direction, i.e., it is unidirectional. Sometimes it is observed counterstreaming, i.e., it is bidirectional. In later sections we discuss how detection of bidirectional heat fluxes has contributed to a more complete understanding of the Earth's bow shock, the bow wave at Comet Giacobini-Zinner, interplanetary plasma structures injected into the solar wind by solar activity processes, and finally polar rain

electrons that are found precipitating over the Earth's poles but are believed to originate in the hot solar corona. DOE

N88-16532*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
RELATIVISTIC ELECTROMAGNETIC WAVES IN AN ELECTRON-ION PLASMA
Abraham C.-L. Chian and Charles F. Kennel Sep. 1987 18 p Submitted for publication Sponsored in part by CNPq, Brazil (Grant NsG-7341)
(NASA-CR-182421; NAS 1.26:182421; INPE-4396-PRE/1216)
Avail: NTIS HC A03/MF A01 CSCL 20I

High power laser beams can drive plasma particles to relativistic energies. An accurate description of strong waves requires the inclusion of ion dynamics in the analysis. The equations governing the propagation of relativistic electromagnetic waves in a cold electron-ion plasma can be reduced to two equations expressing conservation of energy-momentum of the system. The two conservation constants are functions of the plasma stream velocity, the wave velocity, the wave amplitude, and the electron-ion mass ratio. The dynamic parameter, expressing electron-ion momentum conversation in the laboratory frame, can be regarded as an adjustable quantity, a suitable choice of which will yield self-consistent solutions when other plasma parameters were specified. Circularly polarized electromagnetic waves and electrostatic plasma waves are used as illustrations. Author

N88-16533# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Lab. Associado de Plasmas.
NONLINEAR DIFFUSION IN THE PRESENCE OF A TIME-DEPENDENT EXTERNAL ELECTRIC FIELD
Terezinha deLimaeSilva (Centro Tecnico Aerospacial, San Jose dos Campos, Brazil) and Ricardo M. O. Galvao Sep. 1987 10 p Submitted for publication
(INPE-4378-PRE/1198) Avail: NTIS HC A02/MF A01

The influence of a time dependent external electric field on the nonlinear diffusion process studied by Mendonca and Rowlands is investigated. A new solution of the diffusion equation is obtained for the case when electron-ion collisions can be neglected. Author

N88-16534# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Lab. Associado de Plasmas.
EXPERIMENTAL MODEL OF HALO PLASMA OBSERVED IN SMALL-ASPECT FRC PLASMA
Yoshiyuki Aso Apr. 1987 36 p Submitted for publication
(INPE-4159-PRE/1061) Avail: NTIS HC A03/MF A01

The halo plasma, which is a thin plasma surrounding the Field Reversed Configuration (FRC), was observed in the Staged Theta Pinch-Linear (STP-L) experiment. The experimental results show that the ion flow in the halo plasma increases in opposite directions at the vicinity of the separatrix and at the edge of the halo, when the end effect is reduced by the guide field. This double structure of ion flow may be explained by the proposed model that the halo plasma is formed by energetic ions shuttling between the FRC and the open field region, and the numerical result is in a good agreement with the experiment. The proposed model also suggests that the FRC has a good confinement ability for the energetic particles if the plasma does not connect with the discharge tube. Author

N88-16535# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Lab. Associado de Plasmas.
CONCEPTUAL DESIGN OF A RADIO-FREQUENCY DRIVEN COMPACT TOKAMAK
Ricardo M. O. Galvao, L. C. S. Goes, G. O. Ludwig, A. Montes, and M. Ueda Sep. 1987 15 p Presented at the Energy Independence Conference on Fusion Energy and Plasma Physics, Rio de Janeiro, Brazil, 17-21 Aug. 1987
(INPE-4364-PRE/1190) Avail: NTIS HC A03/MF A01

Preliminary results of the design of a small compact tokamak are presented. The design incorporates advanced concepts as start-up and current drive by electron cyclotron and lower hybrid waves, plasma heating by intense ion beams, and achievement of high beta by decreasing the aspect ratio. Author

N88-16536# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A RAY-TRACING STUDY OF ELECTRON CYCLOTRON RESONANCE HEATING IN TOKAMAK PLASMAS WITH A SUPERTHERMAL ELECTRON TAIL
A. Montes and R. O. Dendy (United Kingdom Atomic Energy Authority, Culham, England) Sep. 1987 15 p Submitted for publication Sponsored in part by Conselho Nacional de Desenvolvimento Cientifico e Tecnologico, Brazil
(INPE-4381-PRE/1201; CLM-P-754) Avail: NTIS HC A03/MF A01

A tokamak plasma is considered in which the distribution of electron velocities in the direction parallel to the magnetic field has a monotonically decreasing superthermal tail. A fully three-dimensional ray-tracing code (which includes a realistic antenna pattern, toroidal effects, and refraction) is used to calculate the absorption of the extraordinary mode in the nonrelativistic limit away from perpendicular incidence. The ray-tracing approach extends results previously obtained in slab geometry to a more realistic configuration; it is also essential in dealing with strong refraction in high-density plasmas. The analytical model for the tail presented in this paper makes available a wide range of tail shapes and parameters. At low densities small tails (tail fraction less than 0.5 percent) can significantly affect wave absorption and energy deposition profiles. In a high-density plasma where the fundamental cyclotron resonance is cut-off, tail electrons in the edge region can cause substantial absorption. The use of a gyrotron with frequency much less than the central electron cyclotron frequency with an outside launch position is confirmed as very effective on the presence of very few tail electrons (tail fraction approx. = 0.5 percent). Author

N88-16537# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MAGNETICALLY INSULATED ION DIODE WITH A GAS-BREAKDOWN PLASMA ANODE
J. B. Greenly, Mario Ueda, G. D. Rondeau, and D. A. Hammer (Cornell Univ., Ithaca, N.Y.) Sep. 1987 6 p Presented at the 6th International Conference on High-Power Particle Beams, Kobe, Japan, 1986 Submitted for publication
(Contract N00014-82-K-2059)
(INPE-4382-PRE/1202) Avail: NTIS HC A02/MF A01

An active anode plasma source was operated on the LONGSHOT annular magnetically insulated ion diode. This source uses an inductive voltage from a single turn coil to break down an annular gas puff produced by a supersonic nozzle. The resulting plasma is magnetically driven toward the radial insulating magnetic field in the diode accelerating gap and stagnates as a well-defined surface after about 300 ns to form a plasma anode layer defined by magnetic fields. An ion beam is then extracted from this plasma layer by applying typically a 150 kV, 1 microsecond pulse to the accelerating gap. Optimization of the timing of the gas puff, the plasma production discharge and the high voltage pulse has resulted in 1 microsecond duration 75 to 150 keV ion beam pulses with greater than 100 A/sq cm peak ion current density over an area of about 400 sq cm. Up to 5 J/sq cm was collected by a 4 sq cm calimeter. The diode impedance history can be varied so that rising, flat, and falling voltage pulse waveforms can be produced. Streak photographs of beamlets impinging on a scintillator and time integrated targets both show beam divergence angles equal to or less than 3 degrees, but under certain operating conditions, large excursions in mean aiming angle on time scales of 20 to 200 ns. These and other operating characteristics of the gas-breakdown diode are discussed. Author

N88-16538# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Lab. Associado de Plasmas.
RECENT RESULTS OF PLASMA RESEARCH ACTIVITIES AT THE INSTITUTO DE PESQUISAS ESPACIAIS
J. J. Barroso, J. A. Bittencourt, R. S. Dallaqua, E. DelBosco, A.

Ferreira, J. L. Ferreira, G. P. Galvao, R. M. O. Galvao, G. O. Ludwig, and A. Montes Sep. 1987 10 p Presented at the 5th Japan-Brazil Symposium on Science and Technology, Tokyo, Japan, 1986 Submitted for publication
(INPE-4383-PRE/1203) Avail: NTIS HC A02/MF A01

Results of experiments performed at the Institute for Space Research (INPE) are reported. An enrichment of 390 percent of carbon isotopes was achieved in the plasma centrifuge. The role of ion-acoustic turbulence in the formation of double layers was experimentally investigated. The turbulent spectrum was measured and agrees quite well with the prediction of the modified Kadomtsev renormalized theory. The characteristics of the gyrotron that is being built at INPE and new techniques for gyrotron design are discussed. Theoretical results on the generalized Spitzer-Haerm problem, current drive in the start-up of tokamaks, and quasilinear theory of beat-wave current drive are also presented. Author

N88-16539# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ABSORPTION OF ELECTRON CYCLOTRON WAVES BY SUPERTHERMAL ELECTRON VELOCITY DISTRIBUTIONS IN TOKAMAK PLASMAS
Antonio Montes and R. O. Dendy (United Kingdom Atomic Energy Authority, Culham, England) Sep. 1987 8 p Presented at the Course and Workshop on Applications of RF Waves to Tokamak Plasmas, Varenna, Italy, 1985 Submitted for publication Sponsored in part by Conselho Nacional de Desenvolvimento Cientifico e Tecnologico, Brazil
(INPE-4385-PRE/1205) Avail: NTIS HC A02/MF A01

A tokamak plasma in which the distribution of electron velocities in the direction parallel to the magnetic field has a monotonically decreasing superthermal tail is considered. A fully three-dimensional ray-tracing code is used to calculate the absorption of the extraordinary mode in the nonrelativistic limit. The results indicate that small tails (tail fraction equal to or less than 0.5 percent) can significantly affect wave absorption at low densities. In a high-density plasma where the extraordinary mode cutoff is present, tail electrons can cause substantial absorption. The use of a gyrotron with frequency much less than the central electron cyclotron frequency with an outside launch position is found to be very effective in the presence of tail electrons. Author

N88-16540# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SHAPE OF THE PLASMA BOUNDARY IN TBR
M. E. Conde, R. M. O. Galvao (Sao Paulo Univ., Brazil), I. C. Nascimento, E. K. Sanada, and A. G. Tuszel Sep. 1987 23 p Submitted for publication Sponsored by Fundacao de Amparo a Pesquisa do Estado de Sao Paulo, Brazil and Financiadora de Estudos e Projetos, Brazil
(INPE-4388-PRE/1208) Avail: NTIS HC A03/MF A01

A diagnostic system to determine the shape of the cross section of the plasma column in TBR-1 was developed. The system relies on measurements of radial and azimuthal components of the magnetic field around the plasma column and is based upon a technique developed by Swain and Neilson. It is shown that during normal discharges the plasma column undergoes a systematic downward shift and shrinks in minor and major radii. Author

N88-16541# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ABSORPTION OF ELECTRON CYCLOTRON RADIATION IN TOKAMAK PLASMAS WITH A SUPERTHERMAL TAIL IN THE ELECTRON VELOCITY DISTRIBUTION
Antonio Montes and R. O. Dendy (United Kingdom Atomic Energy Authority, Culham, England) Sep. 1987 36 p Submitted for publication Sponsored in part by Conselho Nacional de Desenvolvimento Cientifico e Tecnologico, Brazil
(INPE-4391-PRE/1211; CLM-P-755) Avail: NTIS HC A03/MF A01

A monotonically decreasing superthermal tail in the distribution of electron velocities parallel to the tokamak magnetic field is represented by adding a drifted Maxwellian distribution to a bulk Maxwellian distribution. This combines a high degree of flexibility in the set of tail parameters available with the possibility of obtaining exact analytic expressions for the dielectric tensor elements. Calculations were carried out in the nonrelativistic limit, which restricts its applicability to the extraordinary mode away from normal incidence. A fully three-dimensional ray tracing code which includes the effects of toroidal geometry is employed. The results indicate that small tails (tail fraction less than 0.5%) can significantly alter the wave absorption characteristics. These include the integrated absorption, spatial deposition profile, and velocity space deposition profile. Due to the presence of tail electrons, significant heating above the high density cutoff is found for high field side launching with omega meson = omega sub e (central), together with strong absorption at low density for low field side launching with omega meson being much less than omega sub e (central). Author

N88-16542# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EXPERIMENTS ON ION-ACOUSTIC RAREFACTIVE SOLITONS IN A MULTI-COMPONENT PLASMA WITH NEGATIVE IONS
Y. Nakamura (Tokyo Univ., Japan), J. L. Ferreira, and G. O. Ludwig Sep. 1987 14 p Previously announced in IAA as A85-44319 Submitted for publication
(INPE-4393-PRE/1213) Avail: NTIS HC A03/MF A01

Ion acoustic solitons in a three component plasma which consists of electrons and positive and negative ions were investigated experimentally. When the concentration of negative ions is smaller than certain value, positive or compressive solitons are observed. At the critical concentration, a broad pulse of small but finite amplitude propagates without changing its shape. When the concentration is larger than this value, negative or rarefactive solitons are excited. The velocity and the width of these solitons are measured and compared with predictions of the Korteweg-de Vries equation which takes the negative ions and the ion temperature into consideration. Head-on and overtaking collisions of the rarefactive solitons were observed to show that the solitons are not affected by these collisions. Author

N88-16543# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Lab. Associado de Plasmas.
DOUBLE LAYER FORMED BY BEAM DRIVEN ION-ACOUSTIC TURBULENCE
G. O. Ludwig, J. L. Ferreira, and A. Montes Aug. 1987 13 p Presented at the Energy Independence Conference on Fusion Energy and Plasma Physics, Rio de Janeiro, Brazil, 17-21 Aug. 1987
(INPE-4292-PRE/1163) Avail: NTIS HC A03/MF A01

Small amplitude steady state ion acoustic double layers are observed to form in a plasma traversed by a beam of cold electrons. The importance of turbulence in maintaining the double layer is demonstrated. The measured wave spectrum is in approximate agreement with models derived from renormalized turbulence theory. The general features of the double layer are compared with results from particle simulation studies. Author

N88-16544# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Lab. Associado de Plasmas.
EXPERIMENTAL INVESTIGATION OF DOUBLE LAYERS FORMED BY ION-ACOUSTIC TURBULENCE
G. O. Ludwig, J. L. Ferreira, and A. Montes Aug. 1987 14 p Submitted for publication
(INPE-4296-PRE/1167) Avail: NTIS HC A03/MF A01

A small amplitude steady state double layer is observed to form in a plasma traversed by cold drifting electrons. The double layer is shown to be associated with the anomalous resistivity caused by the ion acoustic instability driven by the electron beam. The double layer is formed when the beam density is sufficiently large to enhance the instability by a bootstrap action, in agreement with particle simulation studies. Author

N88-16545# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Lab. Associado de Plasmas.
DESIGN, CONSTRUCTION AND OPERATION OF A SMALL RFP FOR TURBULENT PLASMA STUDIES
Y. Aso, R. M. O. Galvao, and M. Ueda Jul. 1987 13 p Presented at the Energy Independence Conference: Fusion Energy and Plasma Physics, Rio de Janeiro, Brazil, 17-21 Aug. 1987
(INPE-4241-PRE/1116) Avail: NTIS HC A03/MF A01

A small Reversed Field Pinch (RFP) apparatus for turbulent plasma studies is described. The apparatus has a major radius of 12 cm and a minor radius of 4.2 cm. First plasma experiments are scheduled to start in Oct. 1987. Author

N88-16546# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Lab. Associado de Plasmas.
PLASMA CENTRIFUGE DEVELOPMENT AT INPE
J. A. Bittencourt, E. DelBosco, R. S. Dallaqua, and G. O. Ludwig Jul. 1987 12 p Presented at the Energy Independence Conference: Fusion Energy and Plasma Physics, Rio de Janeiro, Brazil, 17-21 Aug. 1987
(INPE-4243-PRE/1117) Avail: NTIS HC A03/MF A01

The plasma centrifuge is a device in which a fully ionized plasma column rotates at high angular velocities by means of crossed electric and magnetic fields. Ion angular rotation frequencies of 6.9 x 10,000 to 1.2 x 100,000 rad/s were measured for a carbon plasma, with an externally applied magnetic field of 0.09T. Isotopic enrichments of up to 390 percent for C-13 were measured at 6 cm radius. The steady state behavior of the fully ionized magnetized plasma in the vacuum arc centrifuge was theoretically investigated using a multiple species fluid model, which includes electromagnetic, pressure gradient, centrifugal and collisional forces in cylindrical geometry. Author

N88-16547*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
PLASMA CONTACTORS FOR USE WITH ELECTODYNAMIC TETHERS FOR POWER GENERATION Final Report
D. E. Hastings and N. A. Gatsonis 21 Jan. 1988 29 p
(Grant NAG9-132)
(NASA-CR-182424; NAS 1.26:182424) Avail: NTIS HC A03/MF A01 CSCL 20I

Plasma contactors are proposed as a means of making good electrical contact between biased surfaces such as found at the ends of an electrodynamic tether and the space environment. The plasma contactor emits a plasma cloud which facilitates the electrical connection. The physics of this plasma cloud is investigated for contactors used as electron collectors. The central question addressed is whether the electrons collected by a plasma contactor come from the far field or by ionization of local neutral gas. This question is important because the system implications are different for the two mechanisms. It is shown that contactor clouds in space will consist of a spherical core possibly containing a shock wave. Outside of the core the cloud will expand anisotropically across the magnetic field leading to a turbulent cigar shape structure along the field. This outer region is itself divided into two regions by the ion response to the electric field. A two-dimensional theory for the outer regions of the cloud is developed. The current voltage characteristic of an Argon plasma contactor cloud is estimated for several ion currents in the range of 1 to 100 Amperes. It is suggested that the major source of collected electrons comes by ionization of neutral gas while collection of electrons from the far field is relatively small. Author

N88-16548# FOM-Inst. voor Plasmafysica, Rijnhuizen, Jutphaas (Netherlands).
TANGENTIAL THOMSON SCATTERING
C. J. Barth 1987 20 p Sponsored by Euratom, and the Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek
(Rept-87-173; ETN-88-91605) Avail: NTIS HC A03/MF A01

The experimental set-up for tangential Thomson scattering on TORTUR 4 tokamak is described. The polychromator for drift velocity (vd) measurement, the optical system for tangential scattering; the polychromator for recording nonthermal electron distributions; the expected accuracy in the determination of vd, and the temperature and density of the tail distribution are discussed. Tangential Thomson scattering on TORTUR plasmas offers the ability to determine: Te and ne parallel to the magnetic axis; vd, from the spectral shift, with an accuracy 150,000 m/sec at 2 selectable positions (z = 0 and 46 mm) at ne = 10 to the 20th power/cum; current density from vd and ne; parallel tail distribution up to 20 keV at ne greater than or = 10 to the 18th power/cum, i.e., 1% of the bulk; local anomaly of the conductivity; and deviations from the parallel velocity distribution, which also exist in the radial direction. ESA

N88-16549# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE EFFECT OF ASYMMETRIC CURRENT-SUPPORTING ELECTRON VELOCITY DISTRIBUTIONS ON SECOND HARMONIC ELECTRON CYCLOTRON RESONANCE HEATING: A RAY-TRACING TREATMENT FOR THE COMPASS TOKAMAK
R. O. Dendy (United Kingdom Atomic Energy Authority, Abingdon, England), Antonio Montes, and J. P. Leite Sep. 1987 21 p Repr. from Physics of Fluids (United States), v. 30, no. 4, Apr. 1987 p 1137-1141
(INPE-4389-PRE/1209) Avail: NTIS HC A03/MF A01

A limited asymmetric distortion of the distribution of electron velocities parallel to the magnetic field, sufficient to support the plasma current, is considered. Its effects on second harmonic electron cyclotron absorption of the extraordinary mode propagating away from normal incidence are quantified using a fully three-dimensional ray-tracing code. Significant deviations from the zero current power deposition profiles occur, both in real space and in velocity space. At higher densities, the effects of the extraordinary mode cutoff are softened. These considerations should be taken into account in future studies of temperature and current profile modification using second harmonic electron cyclotron absorption on the COMPASS tokamak. Author

N88-16550# Oak Ridge National Lab., Tenn.
NONLINEAR EVOLUTION OF THE INTERNAL KINK MODE IN TOROIDAL GEOMETRY FOR SHAPED TOKAMAK PLASMAS
J. A. Holmes, B. A. Carreras, L. A. Charlton, V. E. Lynch, R. J. Hastie, and T. C. Hender Sep. 1987 65 p
(Contract DE-AC05-84OR-21400)
(DE88-003655; ORNL/TM-10585) Avail: NTIS HC A04/MF A01

The nonlinear evolution of the internal kink mode is studied in toroidal geometry for noncircular cross section tokamak plasmas. The study is focused on very low shear and hollow q profiles with q(rho) greater than or equal to 1 for which the internal kink is unstable, in the latter case even at Beta = 0. The nonlinear evolution is dominated by ideal magnetohydrodynamics (MHD), and the instability saturates, giving a quasi-helical shift to the magnetic axis. The nonlinear saturation is caused by increased field line bending. Time scales of 10 to the 3rd tau(sub Hp) and axis shifts of 20% are reached when changes in q on the order of 3 x 10 to the -3 power from the marginal profile are produced. DOE

N88-16071# Joint Publications Research Service, Arlington, Va.
NONEQUILIBRIUM IONIZATION OF PREGALACTIC PLASMA AND LESSENING OF RELIC RADIATION ANISOTROPY Abstract Only
P. D. Naselskiy and A. G. Polnarev *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 60 Transl. into ENGLISH from Pisma v Astronomicheskiy Zhurnal (Moscow, USSR), v. 13, no. 3, Mar. 1987 p 167-173 Original language document was announced in IAA as A87-42956 (For primary document see N88-16063 08-42)
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N88-16072# Joint Publications Research Service, Arlington, Va.
UNUSUALLY STRONG DENSITY DECREASE IN NEAR-EARTH INTERPLANETARY PLASMA AND MAGNETICALLY QUIET DAY AS EFFECTS OF ISOLATED SOLAR FLARE Abstract Only
K. G. Ivanov and N. V. Mikerina *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 61 Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow, USSR), v. 27, no. 1, Jan. - Feb. 1987 p 7-11 Original language document was announced in IAA as A87-34227 (For primary document see N88-16063 08-42)
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N88-16076# Joint Publications Research Service, Arlington, Va.
ABSORPTION OF CYCLOTRON RADIATION IN SKIN LAYER IN ARAKS EXPERIMENT Abstract Only
N. I. Izhovkina, S. A. Pulinets, and Ye. P. Trushkina *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 65 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 216-222 Original language document was announced in IAA as A87-41737 (For primary document see N88-16063 08-42)
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N88-16222# Physikalisch-Technische Studien G.m.b.H., Freiburg (West Germany).
DIAGNOSTIC CONCEPT OF THE RESONANCE CONE TECHNIQUE AND ITS APPLICATION IN GROUND AND SPACE EXPERIMENTS
H. Thiemann, A. Hoffmann, and A. Piel (Ruhr Univ., Bochum, West Germany) *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 139-142 (For primary document see N88-16201 08-46)
(Grant BMFT-01-TL-021-ZK/RT)
Copyright Avail: NTIS HC A21/MF A01

N88-16223# Ruhr Univ., Bochum (West Germany). Inst. fuer Experimentalphysik 2.
RESONANCE CONES IN NONTHERMAL PLASMAS: LABORATORY EXPERIMENTS
A. Piel, G. Oelerich (Physikalisch-Technische Studien G.m.b.H., Freiburg, West Germany), and H. Thiemann *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 143-149 (For primary document see N88-16201 08-46)
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N88-16252# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
REMOTE AND IN-SITU PLASMA MEASUREMENTS DURING THE COORDINATED AURORAL EXPERIMENT USING SCATTER AND ROCKETS (CAESAR) FLIGHT
K. Schlegel and K. I. Oyama *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 315-318 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

N88-16588# Ruhr Univ., Bochum (West Germany). Inst. fuer Theoretische Physik.
COUPLING OF MICROSCOPIC AND MACROSCOPIC PROCESSES IN THE EARTH'S MAGNETOTAIL
K. Schindler *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 39-44 Sponsored by Deutsches Forschungsgemeinschaft (For primary document see N88-16582 08-88)
Copyright Avail: NTIS HC A11/MF A01

N88-16589# Mullard Space Science Lab., Dorking (England).
AMPTE-UKS ION OBSERVATIONS AT A QUASI-PARALLEL BOW SHOCK
D. Burgess, A. J. Coates, R. L. Kessel, D. J. Rodgers, and M. W. Dunlop (Imperial Coll. of Science and Technology, London, England) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 45-50 (For primary document see N88-16582 08-88)
Copyright Avail: NTIS HC A11/MF A01

N88-16596# Kiruna Geophysical Inst. (Sweden).
ACCELERATION/HEATING PROCESSES ON AURORAL FIELD LINES AS OBSERVED BY THE VIKING SPACECRAFT
Lars Eliasson and Rickard Lundin *In* ESA, Proceedings of the 21st ESLAB Symposium on Smale Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 87-91 Sponsored by the Swedish Board for Space Activities (For primary document see N88-16582 08-88)
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N88-16603# Riso National Lab., Roskilde (Denmark).
CONDITIONAL SAMPLING IN PLASMA TURBULENCE
H. L. Pecseli and J. Trulsen (Tromsoe Univ., Norway) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 135-138 (For primary document see N88-16582 08-88)
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N88-16604# Kiruna Geophysical Inst. (Sweden). Swedish Inst. of Space Physics.
SMALL SCALE PLASMA DENSITY STRUCTURES OBSERVED BY THE VIKING DOUBLE PROBE INSTRUMENT
G. Holmgren, R. Bostroem, G. Gustafsson, and P. M. Kintner (Tromsoe Univ., Norway) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 139-142 Sponsored by the Swedish Board for Space Activities (For primary document see N88-16582 08-88)
Copyright Avail: NTIS HC A11/MF A01

N88-16610# Imperial Coll. of Science and Technology, London (England). Blackett Lab.
HYDROMAGNETIC CAVITY EIGENMODES IN A NON-UNIFORM PLASMA
D. J. Southwood and W. Allan *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 179-184 (For primary document see N88-16582 08-88)
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N88-16611# Uppsala Ionospheric Observatory (Sweden). Swedish Inst. of Space Physics.
LOW FREQUENCY WAVES AND SMALL SCALE SOLITARY STRUCTURES OBSERVED BY VIKING
Rolf Bostroem,, Hannu Koskinen, and Bengt Holback *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 185-192 Sponsored by the Swedish Board for Space Activities (For primary document see N88-16582 08-88)
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76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N88-16551# Jyvaskyla Univ. (Finland). Dept. of Physics.
ELECTRONIC FACTORS FOR K-SHELL-ELECTRON CONVERSION PROBABILITY AND ELECTRON-POSITRON PAIR FORMATION PROBABILITY IN ELECTRIC MONOPOLE TRANSITIONS
A. Passoja and T. Salonen Apr. 1986 26 p
(DE87-753040; JYFL-RR-2/86) Avail: NTIS (US Sales Only)
HC A03/MF A01

This paper presents, in tabular form, the electronic factors Omega /sub K, pi/(Z,k) of the electric monopole transition probability associated with the internal conversion of an electron from the atomic K shell (IC;K) and with the internal pair formation (IPF;pi). The Omega /sub pi/ values are calculated by taking the nuclear Coulomb effects into account. The corrections to Omega /sub K/ due to finite nuclear size and bound-state atomic screening are not included in the present calculations. The calculated ratio of the K-shell-electron conversion probability to the electron-positron pair formation probability is found to be in good agreement with the available experimental data for Z is equal to or less than 40. DOE

N88-16552# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Lab. Associado Sensores e Materiais.
IMPURITY BANDS IN QUANTUM WELLS
Erasmo A. AndradaeSilva and Ivan CostadaCunhaLima Jul. 1987 8 p Presented at the 3rd Brazilian School of Physics of Semiconductors, Campinas, Brazil, 1987 Submitted for publication
(INPE-4250-PRE/1123) Avail: NTIS HC A02/MF A01

The formation of an impurity band for concentrations realizable in experiments was observed both in Si/SiO2 metal-oxide-semiconductor (MOS) and GaAlAs/GaAs heterostructures. Recent results on the density of state of impurity bands in those systems were discussed and the general features concerning the effects of the gate voltage (MOS) and of the width of the well (GaAlAs/GaAs). The results are also used to serve the interpretation of the observed activation energy of MOS at low temperatures. Author

N88-16553# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
A LABORATORY STUDY OF TIN WHISKER GROWTH
B. D. Dunn, W. R. Burke, ed., and B. Battrick, ed. Sep. 1987 57 p
(ESA-STR-223; ISSN-0379-4067; ETN-88-91411) Copyright
Avail: NTIS HC A04/MF A01

A metallurgical analysis of the mechanism of spontaneous tin whisker growths was performed. Laboratory investigations relate the ubiquity of whiskers to particular types of tin plating and characteristics of the substrate material. Whisker morphologies were discovered and they may have diameters of only 6 nm, although the majority are of the order of 4 micron diameter with lengths approaching 2 mm. Compressive stresses applied to the tin plate do not accelerate whisker growth rates. Nodular eruptions are frequently observed to precede whiskers with short incubation times. Crystallography identifies five whisker growth directions. Together with transmission electron microscope studies, they are shown to be single crystals containing no dislocations or second phases. White to gray tin allotropic transformation at cryogenic temperatures could not be induced. A five-stage model to account for the spontaneous growth of tin whiskers based on the results of the detailed test program is proposed. It is strongly recommended that surfaces known to nucleate whisker growths be excluded from the designs of high reliability equipment. Methods for the prevention of whiskers are suggested, together with finishes found to be immune to such growth phenomena. ESA

N88-16554# Ecole Centrale de Lyon (France).
INFLUENCE OF ARSENIC SUPERFICIAL ENRICHMENT ON THE OHMICITY OF THE n-GaAs:In/Au CONTACT Ph.D. Thesis [INFLUENCE DE L'ENRICHISSEMENT SUPERFICIEL EN ARSENIC SUR L'OHMICITE DU CONTACT N-GAAS: IN/AU]
Patrice Person 1987 146 p In FRENCH
(ECL-87-09; ETN-88-91621) Avail: NTIS HC A07/MF A01

Procedures for arsenic superficial enrichment are described, examining in particular the effect of thermal treatment of anodic oxides. A technique to produce Au:In/As:GaAs electric contacts and their electrical characterization are described. A morphological and structural metal surface investigation is carried out to relate the linearity of contact conductivity to the interface chemistry of the heterostructure. The conductivity of heat treated in:Au/n-GaAs heterostructures appears to be related to the formation of a heterojunction of the type In(x)Ga(1-x)As which could favor As enrichment of the GaAs. ESA

N88-16555# Ecole Centrale de Lyon (France). Lab. d'Electronique, d'Automatique et Mesures Electriques.
PHOTOLUMINESCENCE STUDY OF InP SURFACES AND InP-INSULATOR INTERFACES Ph.D. Thesis [ETUDE DES SURFACES D'INP ET DES INTERFACES INP ISOLANT PAR PHOTOLUMINESCENCE]
Hadj Bourdoucen 1987 126 p In FRENCH
(ECL-87-13; ETN-88-91624) Avail: NTIS HC A07/MF A01

The effect of chemical or heat treatments on the luminescence spectra produced by InP surfaces or interfaces is studied. The application of the results to implement a process control system to manufacture MSI structures is described. The intensity of the spectral peaks is correlated to the electronic characteristics of the junction. It is shown that the described procedures are a valid contribution to improve electronic device quality. ESA

N88-16556# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DIAGONAL AND OFF-DIAGONAL DISORDER IN DOPED QUANTUM WELLS
Erasmo A. deAndradaeSilva, Ivan C. daCunhaLima, Antonio FerreiradaSilva, and Carlos E. S. Leal Jul. 1987 24 p Submitted for publication
(INPE-4255-PRE/1128) Avail: NTIS HC A03/MF A01

The formation of an impurity band in the electronic density of states (DOS) of a quantum well of Ga sub 1-xAl sub x As/GaA is considered. Also considered are both the bandwidth coming out of a fluctuation in the binding energy (diagonal disorder) and a fluctuation in the transfer matrix -V sub ij - due to randomness on the impurity locations in the plane parallel to the interfaces. It is calculated that the DOS for an impurity layer thickness is half the well length, and it is shown that in this case the off-diagonal disorder is dominant. Comparison with experimental results is discussed. Author

N88-16557# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DENSITY OF STATES OF ELECTRONS BOUND TO IMPURITIES IN QUANTUM WELLS OF GaAlAs/GaAs
E. A. deAndradaeSilva, I. C. daCunhaLima, A. FerreiradaSilva, and C. E. Leal Jul. 1987 9 p Presented at the 12th International Conference on Electronic Properties of Two-Dimensional Systems, Santa Fe, N. Mex., Jul. 1987 Submitted for publication
(INPE-4257-PRE/1130) Avail: NTIS HC A02/MF A01

The Density of State (DOS) for electrons bound to impurities in quantum wells of GaAlAs/GaAs heterostructures is calculated according to a realistic model that takes into account diagonal disorder due to dispersion in binding energy and off-diagonal disorder due to randomness in the transfer matrix element. The first one comes out of the dependence of the binding energy on the distance of the impurity to the walls. The second one results from the structural disorder. A method is presented which applies when the ratio between the impurity layer thickness delta and the most likely distance between impurities bar R is small. For instance, if the impurity concentration is 10 to the 15th/cu m and delta =

100 A, delta/bar R = 0.079. If the well width is in the range 100 A is equal to or less than L is equal to or less than 600 A it is found that both diagonal and off-diagonal disorders are of the same order, giving a bandwidth in the range of 1.2 to 5.5 meV. The off-diagonal disorder starts to become dominant as the number of impurities per unit area increases. Author

N88-16558# Oak Ridge National Lab., Tenn.
MAGNETIC INVESTIGATIONS OF SUPERCONDUCTIVE, POLYCRYSTALLINE (RE)1Ba2Cu3O(7-x) COMPOUNDS (RE = Y, Gd, Ho, Dy)
J. R. Thompson, L. A. Boatner, J. Brynestad, D. K. Christen, Y. C. Kim, B. C. Sales, and S. T. Sekula Oct. 1987 5 p Presented at the Fall Meeting of the Materials Research Society, Boston, Mass., 30 Nov. 1987
(Contract DE-AC05-84OR-21400)
(DE88-002537; CONF-871124-3) Avail: NTIS HC A02/MF A01

Magnetic properties have been investigated for several rare-earth based, polycrystalline samples of high T(sub c) superconductive 123 compounds with magnetic onset temperatures between 90 and 95 K. Analysis of the susceptibility chi of samples based on Gd, Ho, and Dy indicates that the superconductive and magnetic properties are independent of one another to a substantial degree. DOE

N88-16559# Tennessee Univ., Knoxville.
SOFT X-RAY ABSORPTION AND EMISSION SPECTRA AND THE ELECTRONIC STRUCTURE OF THE Ba2YCu3O/SUB 7-x/ SUPERCONDUCTOR
K. L. Tsang, C. H. Zhang, T. A. Callcott, L. R. Canfield, D. L. Ederer, J. E. Blendell, C. W. Clark, N. Wassdahl, J. E. Rubensson, and G. Bray 1987 6 p Presented at the 14th International Conference on X-ray and Inner-Shell Processes, Paris, France, 14 Sep. 1987 Prepared in cooperation with National Bureau of Standards, Washington, D.C., Uppsala, Univ, Sweden, Lund Univ., Sweden and Hamburg Univ., Fed. Republic of Germany
(Contract DE-AC05-84OR-21400)
(DE88-002609; CONF-8709135-6) Avail: NTIS HC A02/MF A01

We present e-beam excited soft X-ray emission spectra and total photoelectron yield spectra in the 20 to 600 eV photon energy range for the Ba2YCu3O(7-x) superconductor. We confirm the 2+ valency of Cu in the compound by total yield measurements. In soft X-ray emission, the N/sub 4.5/ spectrum of Ba, the M/sub 4.5/ spectrum of Y, and the K spectrum of O provide measures of the p-type partial density of states (p-PDOS) localized on the respective atomic sites. In each case the p-PDOS is very small at the Fermi energy with the first peak in the p-PDOS lying 3.5 to 4 eV below the Fermi energy. The K spectra of O confirm the interpretation that the structure observed in the photoemission measurements are associated with the O 2p orbitals. Finally no changes are observed between spectra taken above and below T/sub c/. DOE

N88-16560# Sandia National Labs., Albuquerque, N. Mex.
RELAXATION OF METASTABLE SEMICONDUCTOR STRAINED-LAYER STRUCTURES BY PLASTIC FLOW
B. W. Dodson and J. Y. Tsao 1987 15 p Presented at the Fall Meeting of the Materials Research Society, Boston, Mass., 30 Nov. 1987
(Contract DE-AC04-76DP-00789)
(DE88-002729; SAND-87-2695C; CONF-871124-7) Avail: NTIS HC A03/MF A01

The relaxation of misfit strain in metastable structures by plastic flow is described using a continuum model based on Haasen's picture of plastic flow in bulk diamond-phase semiconductors and the concept of excess strain. This model provides a unified explanation of the equilibrium critical thickness, the relaxation behavior of metastable strained-layer structures, and the metastable critical thicknesses reported in many semiconductor strained-layer geometries. DOE

N88-16561# Argonne National Lab., Ill.
COULOMB INTERACTIONS AND EFFECTIVE STRONG COUPLING HAMILTONIANS IN Cu-O SUPERCONDUCTORS
A. J. Fedro, H. B. Schuettler, and S. K. Sinha Aug. 1987 4 p Presented at the 18th Conference on Superconductivity in Highly Correlated Fermion Systems, Sendai, Japan, 31 Aug. 1987 Prepared in cooperation with Exxon Research and Engineering Co., Annandale, N.J.
(Contract W-31-109-eng-38)
(DE88-002942; CONF-870881-7) Avail: NTIS HC A02/MF A01

The effects of virtual Cu-O charge fluctuations in the perovskite high-T(sub c) materials are studied by applying a strong coupling expansion to an extended Hubbard model with hybridized Cu d-orbitals and O p-orbitals. Results for charge fluctuation-mediated site-diagonal effective interactions are discussed. DOE

N88-16562# Argonne National Lab., Ill.
OXYGEN DIFFUSION IN HIGH ′/SUB c/-SUPERCONDUCTORS
J. L. Routbort, S. J. Rothman, B. K. Flandermeyer, L. J. Nowicki, and J. E. Baker 1987 12 p Presented at the Symposium on Diffusion Processes in High Technology Materials, Cincinnati, Ohio, 12 Oct. 1987 Prepared in cooperation with Illinois Univ., Urbana
(Contract W-31-109-eng-38)
(DE88-002965; CONF-8710219-1) Avail: NTIS HC A03/MF A01

Diffusion of O-18 in the superconductor La(sub 2-x)Sr(sub x)CuO(sub 4-y) has been measured as a function of x (0 to 0.20) between 300 and 500 C at an oxygen partial pressure approx. =1 atm. Concentration profiles were obtained using a secondary ion mass spectrometer. The diffusion coefficient decreases with increasing Sr additions from 0.1 to 0.2, primarily because of an increase in activation energy. This result, which is contradictory to the expectation that the diffusion coefficient should increase with increasing vacancy concentration caused by the added Sr, can be explained if oxygen vacancies are bound to Sr clusters. The diffusion coefficients in samples with x = 0 or 0.05 and in the 93 K superconductor YBa2Cu3O7(sub 1-delta) could not be determined, probably because of penetration of oxygen along macroscopic defects. DOE

N88-16563# Argonne National Lab., Ill.
STRUCTURAL PROPERTIES OF HIGH-T/SUB c/ OXIDE SUPER CONDUCTORS
J. D. Jorgensen Aug. 1987 22 p Presented at the 18th Conference on Low Temperature Physics, Kyoto, Japan, 20 Aug. 1987
(Contract W-31-109-eng-38)
(DE88-002974; CONF-870873-19) Avail: NTIS HC A03/MF A01

Structural studies have played a key role in understanding the new oxide superconductors. Neutron powder diffraction techniques have been of particular importance because of the difficulty in synthesizing single crystals of the desired quality and compositions and because of the need to accurately determine the locations and site occupancies of the oxygen atoms. The electronic properties have been shown to depend in a critical way on the structural details of the Cu-O sublattices in these compounds. The La(2-x)M(x)CuO(4-y) (M = Ba, Sr, Ca,...) structure contains a two-dimensional square planar Cu-O sublattice with weak bonding between the layers. The YBa2Cu3O(7-x) structure contains both two-dimensional and one-dimensional Cu-O sublattices, commonly referred to as planes and chains. Closely-related non-superconducting phases which exhibit small differences in stoichiometry or symmetry have also been studied and have provided key insights into the close relationship between structure and superconductivity in these systems. DOE

N88-16564# Argonne National Lab., Ill.
EXPERIMENTAL ASPECTS OF HIGH-T/SUB c/ SUPERCONDUCTORS
K. E. Gray Sep. 1987 13 p Presented at the 3rd Workshop on RF Superconductivity, Argonne, Ill., 14 Sep. 1987

(Contract W-31-109-eng-38)
(DE88-003019; CONF-870955-1) Avail: NTIS HC A03/MF A01

The discussion in this paper is restricted to the YBa2Cu3O(7-x) compound (denoted also as YBCO) which exhibits superconductivity at about 90 K, i.e., above liquid nitrogen temperature of 77 K, since such an increase in operating temperature seems to be the major reason for considering these materials for rf applications. We start with an overview of the various fabrication methods, which include bulk samples made by ceramic processing and thin films made by MBE/electron beam co-evaporation/co-sputtering/pulsed excimer laser evaporation/ etc. Particularly interesting examples include single crystals and epitaxial thin films. Although these are not expected to be useful in cavity applications, they provide us with the best information on the intrinsic properties of the material, from which we can project its potential usefulness if these properties can be duplicated using more practical fabrication methods. This brief review will include examples of microstructure, traditional superconducting properties like T/sub c/, H/sub c2/ and J/sub c/, specific heat, thermal conductivity, photoemission, infrared-red (ir) reflectance, tunneling, and Raman scattering. DOE

N88-16565# Argonne National Lab., Ill.
INTERPRETATION OF THE TEMPERATURE DEPENDENCE OF CONDUCTIVITY IN SUPERCONDUCTING OXIDES
R. J. Thorn 1987 15 p Presented at the 194th American Chemical Society National Meeting, New Orleans, La., 30 Aug. 1987
(Contract W-31-109-eng-38)
(DE88-003028; CONF-870802-30) Avail: NTIS HC A03/MF A01

The diverse variations of the conductivities vs. temperature observed in oxide superconductors can be interpreted with a model based on microcanonical ensembles of a semiconductor and a semimetal originally derived for organic radical cation salts. The equation for the model transverses, through the variations of the Fermi and gap energies and a scattering factor, the range from a semiconductor to a semimetal and defines quantitatively the boundary between the two corresponding to the optimum superconducting state. Therein it describes quantitatively the roles of composition and pressure in determining the onset of the superconducting state. An examination of the published resistivity curves vs. temperature for La(2-x)A(x)CuO(4-delta) and YBa2Cu3O(6.5 + delta) yield information consistent with the model and relevant to the defects and range of homogeneity needed for phase diagrams. DOE

N88-16566# Argonne National Lab., Ill.
THERMODYNAMIC AND CONDUCTIVITY STUDIES OF NONSTOICHIOMETRIC CERIUM DIOXIDE BY COULOMETRIC TITRATION: A SIMULTANEOUS MEASUREMENT
Jong-Hee Park Apr. 1987 18 p Presented at the International Conference on Electronic Structure in Phase Stability in Advanced Ceramics, Argonne, Ill., 17 Aug. 1987
(Contract W-31-109-eng-38)
(DE88-003054; CONF-870843-5) Avail: NTIS HC A03/MF A01

Simultaneous measurements of thermodynamic properties and electrical conductivity for constant compositions in nonstoichiometric cerium dioxide, CeO(2-x) were carried out by coulometric titration in the temperature range 800 to 945 C and oxygen-partial-pressure range 10 to the minus 10th to 10 to the minus 21st atm. The electrochemical, constant-composition technique is used as a fast and direct method for obtaining thermodynamic data and simultaneous measurements of the electrical conductivity. DOE

N88-16567# Argonne National Lab., Ill.
MICROSTRUCTURE MODIFICATIONS OF MICRON THICK NbN FILMS TO IMPROVE J/SUB c/ AND H/SUB c2/
R. T. Kampwirth, K. E. Gray, D. W. Capone, II, J. M. Murduck, and J. F. Lingevitch Jul. 1987 6 p Presented at the Conference on Advances in Cryogenic Engineering, St. Charles, Ill., 14 Jun. 1987
(Contract W-31-109-eng-38)
(DE88-003078; CONF-8706125-20) Avail: NTIS HC A02/MF A01

NbN films have been shown to be good candidate conductors for high field superconducting magnet applications. This paper examined various preparation techniques which could enhance the critical current density J/sub c/ and upper critical field H/sub c2/ of NbN films made by magnetron sputtering. Decreasing film thickness to reduce average grain diameter had little or no effect on J/sub c parallel/, but did increase J/sub c perpendicular/. Layering NbN with thin insulating layers of aluminum nitride resulted in significant increases in J/sub c parallel/. DOE

N88-16568# Argonne National Lab., Ill.
THE ROLE OF THERMODYNAMIC PHASE DIAGRAMS AND LATTICE MATCHING IN SUPERLATTICE GROWTH
I. K. Schuller Aug. 1987 12 p Presented at the 3rd International Conference on Superlattices, Microstructures and Microdevices, Chicago, Ill., 17 Aug. 1987
(Contract W-31-109-eng-38)
(DE88-003113; CONF-8708112-3) Avail: NTIS HC A03/MF A01

Metallic superlattices exhibit a correlation between the epitaxial growth temperature and temperatures extracted from the equilibrium thermodynamic phase diagram. This correlation together with molecular dynamics simulation of epitaxial growth indicates that thermodynamics plays an important role in the growth of epitaxial films, particularly in limiting the sharpness of the interfaces. DOE

N88-16569# California Univ., Berkeley. Lawrence Berkeley Lab.
HIGH T/SUB c/ SUPERCONDUCTOR AS A STRONGLY CORRELATED STATE
V. Z. Kresin Aug. 1987 5 p Presented at the 18th Conference on Superconductivity in Highly Correlated Fermion Systems, Sendai, Japan, 31 Aug. 1987
(Contract DE-AC03-76SF-00098)
(DE88-003194; LBL-24091; CONF-870881-4) Avail: NTIS HC A02/MF A01

A small value of the coherence length and the Fermi energy allows one to consider a new high T(sub c) superconductor as a strongly correlated state. An analysis of the experimental data (La(sub 1.8)Sr(sub 0.2)CuO4) leads to the conclusion that high T(sub c) is provided by the coexistence of the phonon and non-phonon (plasmon) mechanisms of superconductivity. DOE

N88-16494# Joint Publications Research Service, Arlington, Va.
METAL-OXIDE SUPERCONDUCTOR BaPbSUB1-xBiSUBxO3: UNUSUAL PROPERTIES AND NEW APPLICATIONS Abstract Only
A. M. Gabovich and D. P. Moiseyev *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 13-14 Transl. into ENGLISH from Uspekhi Fizicheskikh Nauk (Moscow, USSR), v. 150, no. 4, Dec. 1986 p 599-623 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

N88-16495# Joint Publications Research Service, Arlington, Va.
INSTABILITY OF STRONG-ABSORPTION DOMAIN IN SEMICONDUCTOR Abstract Only
V. A. Stadnik *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 17 Transl. into ENGLISH from Pisma v Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 45, no. 3, 10 Feb. 1987 p 142-144 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

N88-16496# Joint Publications Research Service, Arlington, Va.
EFFECT OF EXTRANEOUS FACTORS ON OPTICAL ONE-PHONON TRANSITIONS IN IMPURITY CENTERS WITH CUBIC SYMMETRY Abstract Only
V. I. Cherepanov, V. N. Frolov, and A. N. Frolov *In its* JPRS

Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 21 Transl. into ENGLISH from Optika i Spektroskopiya (Leningrad, USSR), v. 62, no. 2, Feb. 1987 p 372-380 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

N88-16508# Joint Publications Research Service, Arlington, Va.
NEW BRANCH OF SOLID-STATE PHYSICS Abstract Only
V. Ye. Panin *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 49-50 Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedeniy: Fizika (Tomsk, USSR), v. 30, no. 1, Jan. 1987 p 3-8 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N88-16570# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Pure Mathematics.
RELATIVISTIC CALOGERO-MOSER SYSTEMS AND SOLUTIONS
S. N. M. Ruijsenaars Jan. 1987 12 p Submitted for publication
(CWI-PM-R8702; B8709687; ETN-88-91590) Copyright Avail: NTIS HC A03/MF A01

Results pertaining to a class of completely integrable N-particle systems, which generalize the Calogero-Moser (CM) systems, are reviewed. The systems are relativistically invariant, and the CM systems result from taking a parameter to infinity, which may be regarded as the speed of light. They can be quantized in such a fashion that integrability is preserved. However, only the classical level is discussed. A matrix whose symmetric functions yield N independent commuting Hamiltonians is used to construct the action-angle map. The relation of the particle systems to soliton equations is analyzed. Solutions consisting of solitons, antisolitons, breathers, etc... may all be viewed as manifestations of underlying point particle dynamics associated with the systems. The relation leads to a natural concept of soliton space-time trajectory. ESA

N88-16571# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
A NOTE ON FUJIKAWA'S METHOD OF DETERMINING THE CRITICAL DIMENSION OF THE RELATIVISTIC STRING
D. N. Petcher and J. W. vanHolten Apr. 1987 6 p Sponsored in part by FOM-Inst. voor Plasmafysica
(NIKHEF-H/87-5; B8721877; ETN-88-91600) Avail: NTIS HC A02/MF A01

Fujikawa's (1982) derivation of the critical dimension of the relativistic string in the path integral formulation is considered. It is shown that the correct prescription for choosing the functional measure is obtained by requiring standard BRST-invariance without modifications and that Fujikawa's choice of measure is not unique. A one-parameter family of BRST-invariant measures is found, even after fixing a gauge for local Weyl rescalings. Gauge independence of the resulting theory is demonstrated in the critical number of dimensions. ESA

N88-16509# Joint Publications Research Service, Arlington, Va.
EXISTENCE OF ABSOLUTELY CLOSED UNIVERSE Abstract Only
M. A. Markov *In its* JPRS Report: Science and Technology. USSR: Physics and Mathematics 29 Oct. 1987 p 54 Transl. into ENGLISH from Pisma v Zhurnal Eksperimentalnoy i Teoreticheskoy Fiziki (Moscow, USSR), v. 45, no. 2, 25 Jan. 1987 p 61-64 (For primary document see N88-16485 08-70)
Avail: NTIS HC A04/MF A01

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N88-16572# National Aerospace Lab., Amsterdam (Netherlands).
REALIZATION OF THE IMMEDIATE OBJECTIVES OF THE AERO-GAS DYNAMICS AND VIBRATION LABORATORY (LAGG) AT THE NATIONAL CENTER FOR RESEARCH, SCIENCE AND TECHNOLOGY (PUSPIPTEK) AT SERPONG, JAVA (INDONESIA), PROJECT TTA-79 Progress Report, Jul. - Dec. 1986
Martin Laihad and J. P. Klok 1986 93 p Prepared in cooperation with the Agency for Assessment and Application of Technology, Jakarta, Indonesia, the Bandung Inst. of Technol., Indonesia and Technische Hogeschool, Delft, Netherlands
(GG/QPR-10; ETN-88-91323) Avail: NTIS HC A05/MF A01

The administration, planning, and status of a project to construct an aero-gas dynamics and vibration laboratory are summarized. ESA

N88-16573# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
THE APPROPRIATE USE OF CONTRACT TYPES IN DEVELOPMENT CONTRACTS (A SYSTEMS APPROACH WITH EMPHASIS ON THE EUROPEAN SPACE SECTOR)
W. A. Peeters and W. R. Burke, ed. Oct. 1987 150 p
(ESA-STR-222; ISSN-0379-4067; ETN-88-91410) Copyright Avail: NTIS HC A07/MF A01

A general contract model and its characteristics were established, while specific models for the three contractual parameters of major influence (cost, delivery time, and performance) were developed. It is possible to establish specific formulas for cost and delivery incentives. Qualitative guidelines for performance and multiple incentives are presented. A model is presented in the form of a decision tree. This makes it possible to select objectively the most appropriate type of contract while taking into account the various environmental influencing factors together with the interests of client and contractor. The model and its underlying rationale help to bridge the communication gap that separates technical staff and contract administrators. ESA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.

For computer documentation see *61 Computer Programming and Software.*

N88-16574# Defense Technical Information Center, Alexandria, Va. Office of Information Systems and Technology.
DOD GATEWAY INFORMATION SYSTEM (DGIS) COMMON COMMAND LANGUAGE: PROLOG KNOWLEDGE BASE PROFILE. COMMON COMMAND LANGUAGE REPORT NO. 3
Duc T. Tran Oct. 1987 8 p
(AD-A186150; DTIC/TR-87/23; DTIC-AI-FOUNDATION-SER-5)
Avail: NTIS HC A02/MF A01 CSCL 05B

The initial phase of the Common Command Language (CCL) project was prototyped in C language. A test and evaluation of the prototypes showed that much more was needed to handle the wide variety and disparity of native command languages and operating characteristics of the multitude of information systems. PROLOG was chosen as a simple but powerful relational programming language based on the idea of programming in logic. PROLOG additionally fits well with the plan for gradual migration from a structured command language to a natural language. The current phase of the project utilizes Artificial Intelligence techniques of blackboard architecture and knowledge bases. PROLOG is the primary implementation language, coupled with low level system-related support functions written in C. GRA

N88-16575* National Aeronautics and Space Administration, Washington, D.C.
NASA THESAURUS SUPPLEMENT: A FOUR PART CUMULATIVE SUPPLEMENT TO THE 1985 EDITION OF THE NASA THESAURUS
Jan. 1988 363 p
(NASA-SP-7053(Supp-4); NAS 1.21:7053(Supp-4)) Avail: NTIS HC A16 CSCL 05B

The four part cumulative NASA Thesaurus Supplement to the 1985 edition of the NASA Thesaurus includes Part 1, Hierarchical Listing, Part 2, Access Vocabulary, Part 3, NASA Thesaurus Definitions, and Part 4, Changes. The semiannual supplement gives complete hierarchies for new terms. Author

N88-16576# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PROPOSAL OF A METHODOLOGY FOR THE CONCEPTUAL DESIGN OF THE DISTRIBUTED DATA BASE M.S. Thesis, 8 Jul. 1986 [PROPOSTA DE UMA METODOLOGIA PARA O PROJETO CONCEITUAL DE BANCOS DE DADOS DISTRIBUIDOS]
Petronio Osorio Costa Aug. 1987 197 p In PORTUGUESE; ENGLISH summary
(INPE-4315-TDL/282) Avail: NTIS HC A09/MF A01

The methodologies for the Distributed Data Base (BDD) design relies on the software life cycle. However, they left to the logical design phase the considerations for the distribution of the data by the various data bases (BD) of the system. This approach makes the stepwise design difficult; a great part of the work done to the views integration is lost on the distribution phase. This work proposes a methodology for the conceptual design of the BDD, which obtains a global schema with a little effort and cost and contains the master line for all the distributed system. For the development of each of the BDs of the distributed system, conventional methodologies for its design are used. To illustrate the application of this methodology, the (distributed) conceptual model for a hypothetical personal system is obtained. Author

N88-16577*# National Academy of Sciences - National Research Council, Washington, D. C.
CRITICAL ISSUES IN NASA INFORMATION SYSTEMS Final Report
Jun. 1987 68 p
(Contract NASw-4124)
(NASA-CR-182380; NAS 1.26:182380; PB88-101027) Avail: NTIS HC A04/MF A01 CSCL 05B

The National Aeronautics and Space Administration has developed a globally-distributed complex of earth resources data bases since LANDSAT 1 was launched in 1972. NASA envisages considerable growth in the number, extent, and complexity of such data bases, due to the improvements expected in its remote sensing data rates, and the increasingly multidisciplinary nature of its scientific investigations. Work already has begun on information systems to support multidisciplinary research activities based on data acquired by the space station complex and other space-based and terrestrial sources. In response to a request from NASA's former Associate Administrator for Space Science and Applications, the National Research Council convened a committee in June 1985 to identify the critical issues involving information systems support to space science and applications. The committee has suggested that OSSA address four major information systems issues; centralization of management functions, interoperability of user involvement in the planning and implementation of its programs, and technology. GRA

N88-16578*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FY87 SCIENTIFIC AND TECHNICAL REPORTS, ARTICLES, PAPERS, AND PRESENTATIONS
Joyce E. Turner, comp. Oct. 1987 63 p
(NASA-TM-100318; NAS 1.15:100318) Avail: NTIS HC A04/MF A01 CSCL 05B

The document presents formal NASA technical reports, papers published in technical journals, and presentations by MSFC personnel in FY87. It also includes papers of MSFC contractors. After being announced in STAR, all of the NASA series reports may be obtained from the National Technical Information Service, 5285 Port Royal Road, Springfield, Va. 22161. The information in this report may be of value to the scientific and engineering community in determining what information has been published and what is available. Author

N88-16579# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AGARD REPORTS: A QUARTERLY LISTING, 1 JULY THROUGH SEPTEMBER 30, 1987
Oct. 1987 5 p
(AD-A186572) Avail: NTIS HC A02/MF A01 CSCL 05B

This is a listing of unclassified AGARD publications NASA received and announced in the NASA abstract journal Scientific and Technical Aerospace Reports during the quarter cited above. These unclassified reports are also available from the Defense Technical Information Center and may be purchased from the National Technical Information Service. GRA

N88-16377*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HSTDEK: DEVELOPING A METHODOLOGY FOR CONSTRUCTION OF LARGE-SCALE, MULTI-USE KNOWLEDGE BASES
Michael S. Freeman *In its* Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 89-94 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 05B

N88-16423*# Boeing Aerospace Co., Huntsville, Ala.
FOUNDATION: TRANSFORMING DATA BASES INTO KNOWLEDGE BASES
R. B. Purves, James R. Carnes, and Dannie E. Cutts (Boeing Co., Huntsville, Ala.) *In* NASA. Marshall Space Flight Center, Third Conference on Artificial Intelligence for Space Applications, Part 1 Nov. 1987 p 353-357 (For primary document see N88-16360 08-61)
Avail: NTIS HC A18/MF A01 CSCL 05B

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see also *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N88-16580# Ministerie van Onderwijs en Wetenschappen, s'Gravenhage (Netherlands).
TRENDS IN RESEARCH AND DEVELOPMENT IN THE NETHERLANDS. THE INFLUENCE OF NATIONAL SCIENCE POLICY BETWEEN 1973 AND 1986
W. J. Tempel and J. E. vanDam Jun. 1986 40 p
(B8701588; ETN-88-91604) Avail: NTIS HC A03/MF A01

Research trends in energy technology, remote sensing, space, marine sciences, environment, toxicology, biotechnology, microelectronics, information technology, materials science, health, behavioral and social sciences, demography and the labor market are summarized. ESA

N88-16581# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ORGANIZATIONS OF INTERMEDIATION IN TECHNOLOGY TRANSFER: ITS ROLE IN TECHNOLOGICAL INNOVATION M.S. Thesis [ORGANIZACOES DE INTERMEDIACAO EM TRANSFERENCIA DE TECHNOLOGIA: SEU PAPEL NA INOVACAO TECHNOLOGICA]
Sergio Alves Perilo Sep. 1987 266 p In PORTUGUESE; ENGLISH summary
(INPE-4354-TDL/297) Avail: NTIS HC A12/MF A01

The role and the modus operandi of some organizations supposed to promote the approximation between the productive sector and the research institutions in Brazil are analyzed. The first part of the work is a survey of the literature on the process of technological innovation and on the relationship between the research institutes and the productive sector. The second section is a field study that gathered data and information about the objectives, structure, ways and areas of activity, main sources of funding, relationsips with other institutes, and barriers to action of six of those organizations. The chosen organizations are Cia. de Desenvolvimento Technologico S/A (CODETEC), Cia. de Promocao da Pesquisa Cientifica e Tecnologica do Estado de Sao Paulo (PROMOCET), Fundacao para o Desenvolvimento Tecnologico da Engenharia (FDTE), Fundacao de Ciencia, Aplicacores e Technologia Espaciaia (FUNCATE), Fundacao E.J. Zerbini (FEJZ), and Fundacao Padre Leonel Franca (FPLF). The study reached some interesting conclusions, among which the recognition of the usefulness of those organizations and of the existence of a legitimate space they may and should occupy deserve special mention. Author

88 SPACE SCIENCES (GENERAL)

N88-16582# European Space Agency, Paris (France).
PROCEEDINGS OF THE 21ST ESLAB SYMPOSIUM ON SMALL SCALE PROCESSES IN THE CHROMOSPHERE/CORONA, INTERPLANETARY MEDIUM AND PLANETARY MAGNETOSPHERES
B. Battrick, ed. and E. J. Rolfe, ed. Aug. 1987 234 p Symposium held in Bolkesjoe, Norway, 22-25 Jun. 1987; sponsored by ESA, and the Norwegian Space Center
(ESA-SP-275; ISSN-0379-6566; ETN-88-91134) Copyright Avail: NTIS HC A11/MF A01

Magnetic field reconnection and the solar prominence/corona transition region; field aligned phenomena; small and medium scale plasma instabilities; and magnetohydrodynamic (MHD) waves were discussed. For individual titles, see N88-16583 through N88-16614.

N88-16583*# New Hampshire Univ., Durham. Space Science Center.
MAGNETIC RECONNECTION AND SOLAR FLARE LOOPS
T. G. Forbes *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 3-9 (For primary document see N88-16582 08-88)
(Grants NAGw-76; NSF ATM-85-07035)
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Reconnection models of the main phase of large solar flares are used to explain the energetics and the motions of the large flare loops that occur during this phase. Correct predictions for the density and temperature of the X-ray emitting loops are obtained by coupling magnetic reconnection with chromospheric ablation. In the reconnection models the ablation is driven by the thermal conduction of heat along magnetic field lines connecting the reconnection shocks in the corona with the flare ribbons in the chromosphere. Combining the compressible reconnection theory of Soward and Priest (1982) with the magnetohydrodynamic (MHD) subshock criteria of Coroniti (1970) shows that the Petschek-type slow-mode shocks in the vicinity of the x-line always dissociate into pairs of isothermal slow-mode subshocks and thermal conduction fronts. The rate of expansion of the loops is a function of the reconnection rate, and loops can be evolving self-similarly in time with their height increasing as sq root t and the reconnection rate decreasing as t to the minus 1. ESA

N88-16584# Tromsoe Univ. (Norway).
SOLAR CORONA AND SOLAR WIND **c92**
Egil Leer *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 11-19 (For primary document see N88-16582 08-88)
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Parker's thermally driven solar wind model is reviewed. The model can describe the quiet solar wind quite well, but energy must be added to the flow to drive high speed streams. It is argued that the Solar and Heliospheric Observatory (SOHO) should be used to study possible acceleration mechanisms of the solar wind, in particular acceleration by magnetohydrodynamic (MHD) waves. In the inner corona a nonnegligible wave energy flow introduces a substantial nonthermal broadening of lines from heavy ions. Simultaneous observations of line widths and of the corona density profile in the source region of the solar wind, as well as the flow emanating from that region, should lead to a better understanding of the energy balance in the solar wind. ESA

N88-16585# Oslo Univ. (Norway). Inst. of Theoretical Astrophysics.
OBSERVATIONS AND MODELING OF THE PROMINENCE/CORONA TRANSITION REGION **c92**
O. Engvold, O. Kjeldseth-Moe, J.-D. F. Bartoe, and G. E. Brueckner

(Hulburt, E. O. Center for Space Research, Washington, D.C) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 21-25 (For primary document see N88-16582 08-88)
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The construction of inhomogeneous temperature transition region models for solar prominences is considered. Models based on UV line intensities from SO82B on Apollo Telescope Mount (ATM)/Skylab and the High Resolution Telescope and Spectrograph (HRTS) on Spacelab 2 are derived. The modeled structures of the transition region are in the form of thin tubes, similar to the prominence structures seen in the cool core. An expression for the thickness of the transition region around prominences is given, and mechanisms for energy transport are discussed. Uncertainties and possible improvements in the modeling are pointed out. ESA

N88-16586# Oslo Univ. (Norway). Inst. of Theoretical Astrophysics.
GASFLOWS IN THE TRANSITION REGION ABOVE SUNSPOT
O. Kjeldseth-Moe, N. Brynildsen, P. Brekke, J.-D. F. Bartoe, and G. E. Brueckner (Hulburt, E. O. Center for Space Research, Washington, D.C) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 27-31 (For primary document see N88-16582 08-88)
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Gas flows in the transition region in and above sunspots were observed with the High Resolution Telescope and Spectrograph on two rocket flights and during the Spacelab 2 mission. Supersonic downflows of mass from the corona appear to be generally occurring in sunspots. The downflows are often concentrated in regions with typical diameters of 4000 km on the Sun, suggesting a flow in a looplike structure. However, the total flow pattern often has an elongated sheetlike structure of much larger extent. Flow speeds are typically 80 km/sec and show small variation with the temperature of the radiating gas. Much higher flowspeeds (180 km/sec) also occur. Studies of the areas surrounding the sunspot in the Spacelab material reveal the presence of upflows over extended regions with flowspeeds of 10 to 30 km/sec. It is not clear whether the amount of upward flowing gas is sufficient to compensate for the mass flux in the downflows. ESA

N88-16587# Oslo Univ. (Norway). Dept. of Physics.
INTERPLANETARY AND GEOPHYSICAL EFFECTS OF A CORONAL TRANSIENT **c92**
P. E. Sandholt *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 33-38 (For primary document see N88-16582 08-88)
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A study of the flare-related coronal transient on Nov. 27, 1979, with the resulting interplanetary (IP) shock and the associated auroral and magnetic effects that were observed from the ground is presented. The observed disturbance of the interplanetary magnetic field (IMF) is discussed in relation to a model of flare-related perturbations. Distinct signatures related to the IP disturbance are observed in the polar cusp aurora, in the local magnetic field, and at the conjugate location in Antarctica. A sharp IMF B sub y polarity change is interpreted as the effect of a kinky heliospheric current sheet. The related responses in the earth's cusp currents are shown. ESA

N88-16588# Ruhr Univ., Bochum (West Germany). Inst. fuer Theoretische Physik.
COUPLING OF MICROSCOPIC AND MACROSCOPIC PROCESSES IN THE EARTH'S MAGNETOTAIL **c75**
K. Schindler *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 39-44 Sponsored by Deutsches Forschungsgemeinschaft (For primary document see N88-16582 08-88)
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Coupling between processes on small and large scales in the magnetotail is discussed. The main large-scale dynamic feature, the formation and acceleration of plasmoids, is surprisingly independent of the microscopic dissipation process. However, the influence of the dissipation on quantitative properties of the occurring wave forms, notably on the growth rate, is strong. The transition from two to three dimensional descriptions raises difficulties, e.g., the notion of magnetic reconnection, which seems to require a better foundation in general three-dimensional fields. ESA

N88-16589# Mullard Space Science Lab., Dorking (England).
AMPTE-UKS ION OBSERVATIONS AT A QUASI-PARALLEL BOW SHOCK **c75**
D. Burgess, A. J. Coates, R. L. Kessel, D. J. Rodgers, and M. W. Dunlop (Imperial Coll. of Science and Technology, London, England) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 45-50 (For primary document see N88-16582 08-88) Copyright Avail: NTIS HC A11/MF A01

A crossing of the quasi-parallel terrestrial bow shock is examined using data from the AMPTE-UKS ion instrument and magnetometer. The three dimensional capabilities of the ion instrument are emphasized. The plasma transition at the shock occurs fairly sharply. The downstream ion distributions show considerable bunching and clumpiness in velocity space when viewed at 5 sec time resolution, but appear more isotropic when averaged over longer periods. Ahead of the shock gyrating ions are observed, similar to those reported by Gosling, et al., (1982). However, the gyration velocity does not agree with the prediction of simple specular reflection, and it is conjectured that the gyrational signature is a product of the particular form of upstream injection and wave-particle interaction. ESA

N88-16590# Science Research Council, Chilton (England). Rutherford Appleton Lab.
THE FORMATION OF BOUNDARY LAYERS BY THE ENTRY OF LOW-ENERGY ELECTRONS AND ENERGETIC IONS INTO THE EARTH'S MAGNETOSPHERE **c46**
C. P. Chaloner, D. R. Lepine, D. S. Hall, D. A. Bryant, W. Stuedemann, B. Wilken, G. Kremser, F. Soeraas, K. Broenstad, and J. F. Fennell (Aerospace Corp., Los Angeles, Calif.) et al. *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 51-56 (For primary document see N88-16582 08-88)
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Entry of heated solar wind plasma into the magnetosphere is examined using electron measurements from AMPTE-UKS and energetic ion measurements from Viking (Swedish satellite). The characteristics (particularly the angular structure) of electrons within the magnetopause and its boundary layers are studied. It is concluded that while the low latitude boundary layer electrons originate in the magnetosheath, the halo population is a mixture, consisting of electrons from the inner magnetosphere with injection of a magnetosheath component at small pitch angles. The magnetosheath plasma is found to cross the magnetopause at low latitudes on the dayside rather than in the cusp/cleft. The magnetic field topology is discussed, with particular reference to Viking observations. ESA

N88-16591# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France). Lab. de Physique Stellaire et Planetaire.
FLUX TUBES AND LOOPS IN THE SOLAR CHROMOSPHERE AND CORONA **c92**
Bernard H. Foing *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar

Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 59-63 (For primary document see N88-16582 08-88)
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Solar observations at high angular resolution show that the solar magnetic field is structured in fluxtubes of 1.5 kG and less than 1 arcsec size at the photospheric level. Manifestations of these fluxtubes can be diagnosed in the chromosphere and transition region with EUV images in 160 nm continua or in the L sub y alpha and C IV lines formed at different heights and temperatures. The equilibrium configuration of the fluxtubes is reviewed for different models: thin tubes, static loops, steady flows, and numerical unstationary simulations. In order to describe the pressure and energy balance from the photospheric to the coronal configurations, it is necessary to determine such parameters as the temperature, electronic density, and velocities that will be measured with the coronal instruments on board the Solar and Heliospheric Observatory (SOHO). ESA

N88-16592*# California Univ., Berkeley. Space Sciences Lab.
MICROPHYSICS OF THE AURORAL ACCELERATION REGION OF OTHER REGIONS OF THE MAGNETOSPHERE c46
F. S. Mozer, C. A. Cattell, M. Temerin, and J. Wygant *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 65-72 (For primary document see N88-16582 08-88)
(Grant NAG5-375)
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Electric field and plasma measurements pertinent to the microphysics of the auroral acceleration region are reviewed. Observations in other regions of the magnetosphere, which appear to involve similar physical processes, are summarized in order to emphasize the requirement on Cluster instrumentation for wide dynamic range, high time resolution, time domain field, and particle measurements. It is suggested that the microphysics of current driven instabilities in the auroral acceleration region is duplicated in the high latitude boundary of the plasma sheet and that the macroscale structure of the tail is determined by this microphysics. ESA

N88-16593# Air Force Geophysics Lab., Hanscom AFB, Mass.
A UNIFIED MODEL FOR THE WTS AND THE GENERATION ON Pi 2 PULSATIONS c46
P. L. Rothwell, M. B. Silevitch, and L. P. Block (Royal Inst. of Tech., Stockholm, Sweden) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 73-78 (For primary document see N88-16582 08-88)
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A unified model of the Westward Traveling Surge (WTS) and the generation of Pi 2 pulsations is presented. The motion of the WTS as a function of the precipitating electron energy and the concurrent generation of Pi 2 pulsations via a feedback instability are reviewed. The physical consequences of requiring the Pi 2 pulsations to be bounded are considered. It is found that the electron temperature anisotropy in the plasma sheet plays a major role in determining the direction in which a surge region of a given northsouth dimension propagates. Narrower surges require greater electron heating parallel to the magnetic field for poleward motion. More energetic electrons are predicted to produce Pi 2 pulsations at higher frequencies. Pulsations occur in multiple bursts with the time interval between bursts being shorter for shorter field lines. Initial amplitude and phase conditions are crucial in determining pulse shape. ESA

N88-16594# Los Alamos National Lab., N. Mex. ESS-8.
A POSSIBLE ROLE FOR IONOSPHERIC IONS IN TRIGGERING A GEOMAGNETIC SUBSTORM ONSET c46
Theodore A. Fritz *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 79-82 (For primary document see N88-16582 08-88)
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A model for the triggering of a geomagnetic substorm which involves the transport of cold ionospheric ions from the high latitude, cusp region across the polar cap/lobe to the plasma sheet boundary layer in response to enhanced reconnection at the subsolar magnetopause is proposed. The ions enter the plasma sheet boundary layer at distances which depend on the mass of the ion and are concentrated there by the lack of further convections in the closed field line region of the plasma sheet. The ions mass load the plasma sheet boundary layer and change the plasma sheet from a condition of marginal stability to one in which the field becomes frozen-in to the motion of this population. The development of a tail-like field close to the Earth leads to the formation of a near-earth neutral or X-line and the ejection of a plasmoid down the tail. ESA

N88-16595# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
FIELD-ALIGNED FLUXES OF ENERGETIC ELECTRONS RELATED TO THE ONSET OF MAGNETOSPHERIC SUBSTORMS c46
G. Kremser, A. Korth, S. L. Ullaland, A. Roux, S. Perraut, A. Pedersen, R. Schmidt, and P. Tanskanen *In* ESA, Proceedings of the 21st ESLAB Symposium on Small-Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetry Medium and Planetary Magnetospheres Aug. 1987 p 83-86 (For primary document see N88-16582 08-88)
(Contract BMFT-PT-RV-14B12/73-WRK-243-SF)
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Observations of bidirectional field-aligned fluxes of energetic electrons (16 to 80 keV) at magnetic substorm onset are discussed. The electron fluxes appear 4 min after the onset of the expansion phase, last 1.5 min, and are associated with strong spatial gradients of the ion intensity. The observations are interpreted in terms of a model in which a surface wave develops at the transition from dipolelike to taillike geomagnetic fieldlines. The surface wave couples into kinetic Alfven waves that propagate along the fieldlines, are reflected at the ionosphere, and interact with mirrored electrons on their way back towards the equatorial plane. ESA

N88-16596# Kiruna Geophysical Inst. (Sweden).
ACCELERATION/HEATING PROCESSES ON AURORAL FIELD LINES AS OBSERVED BY THE VIKING SPACECRAFT c75
Lars Eliasson and Rickard Lundin *In* ESA, Proceedings of the 21st ESLAB Symposium on Smale Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 87-91 Sponsored by the Swedish Board for Space Activities (For primary document see N88-16582 08-88)
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High resolution data from the hot plasma experiment on board the Swedish Viking satellite are presented. Characteristics of the particle populations contain information about local and remote acceleration and heating processes. The energy and especially the angular distributions obtained in the auroral region show considerably more structure than anticipated. Quasi-static electric field acceleration explains many of the features observed, but other large-scale and small-scale processes such as various wave particle interaction mechanisms are needed to more completely understand the particle observations. ESA

N88-16597*# Hulburt (E. O.) Center for Space Research, Washington, D.C. Naval Research Lab.
EMERGING FLUX, MAGNETIC RECONNECTION, PLASMA TURBULENCE AND WAVES IN THE TRANSITION ZONE OF THE SOLAR ATMOSPHERE c92
G. E. Brueckner *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 95-104 (For primary document see N88-16582 08-88)

(NASA Order H-27288-B; NASA Order S-65062-B; NASA Order W-14541)
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Ultraviolet spectroscopy of the solar transition zone, especially Spacelab 2 results, is reviewed. Emerging magnetic flux is considered as the energy source of the solar corona and the solar wind. The conversion of magnetic into kinetic energy is facilitated in the transition zone because of unique conditions. Radiation losses are sufficient to create fast instabilities. Observed nonthermal velocities in spectra of the transition zone indicate the existence of strong plasma oscillations and turbulence. The small filling factor of the transition zone indicates a highly filamentary structure of density, magnetic field strength, and currents, which results in rapid reconnection time scales. Particle acceleration and the heating of the corona are placed in the areas of strong plasma oscillations of the transition zone. ESA

N88-16598# Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. of Astronomy.
SMALL-SCALE STRUCTURE IN SOLAR FLARE RADIO EMISSION c92
A. O. Benz *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 105-108 (For primary document see N88-16582 08-88)
(Grant SNSF-2.019-0.86)
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High resolution radio observations of type 3 solar flares and spike bursts are presented. Considerable fragmentation appears in time and spectrum, indicating that many, small sources are involved. The structure in type 3 emission requires more than 100 distinct injections or acceleration events in a flare studied. There are suggestions of orders of magnitude higher fragmentation in the acceleration process from type 3 bursts and spikes. Small scale structures in flares may control the energy release and its time scale. ESA

N88-16599# Katholieke Universiteit te Leuven (Belgium). Inst. of Astronomy.
THE EFFECTS OF VISCOSITY ON RESISTIVE BALLOONING MODES IN LINE-TIED CORONAL MAGNETIC FIELDS c92
R. VanderLinden, M. Goossens, and A. W. Hood (Saint Andrew's Univ., Scotland) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 109-114 (For primary document see N88-16582 08-88)
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The study of resistive ballooning instabilities in line-tied coronal magnetic fields is extended by including viscosity in the stability analysis. The equations that govern the resistive ballooning instabilities are derived and the effects of viscosity are included using Braginskii's stress tensor. Numerical solutions to the equations are obtained under the rigid wall boundary conditions for arcades with cylindrically symmetric magnetic fields. The stabilizing influences of parallel and perpendicular viscosity are investigated. Perpendicular viscosity is more important and can lead to complete stabilization. ESA

N88-16600*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NUMERICAL SIMULATION OF SOLAR WIND AND MAGNETOSPHERIC PHENOMENA
Melvyn L. Goldstein, D. Aaron Roberts, Sanjoy Ghosh, and William H. Matthaeus (Delaware Univ., Newark.) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 115-124 Sponsored in part by the NASA Solar Terrestrial Program (For primary document see N88-16582 08-88)
(Grant NSF ATM-86-09740)
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The nature of the nonlinear evolution of Kelvin-Helmholtz instability in the presence of sheared magnetic fields was investigated via numerical simulation. Models of the magnetosheath-magnetopause boundary in earth's tail and stream interaction regions in the inner heliosphere were studied. The development of the instability is influenced strongly by the orientation and magnitude of the magnetic field. Large vortical structures that resemble observations in the earth's tail can form while other cases generate turbulent spectra that provide insight into the generation of Alfven turbulence in the solar wind. ESA

N88-16601*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
EVIDENCE OF SMALL-SCALE RECONNECTION IN THE MAGNETOSPHERE c46
R. C. Elphic, C. T. Russell, and D. J. Southwood (Imperial Coll. of Science and Technology, London, England) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 125-130 Sponsored in part by the United Kingdom Science and Engineering Research Council (For primary document see N88-16582 08-88)
(Contract NAS5-28448; Grant NAG5-536)
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Flux transfer events (FTE's) at the magnetopause, and brief, intense flows in the magnetotail plasma sheet are discussed. Nearly simultaneous observations of FTE's at the dayside magnetopause by the AMPTE-UKS and IRM spacecraft near the equator, and by ISEE-1 and 2 at the same local time but 5 R sub e to the south are shown. In the magnetotail, ISEE-1 and 2 data show that 2 to 10 min intense (200 to 1000 km/sec) flows occur at the neutral sheet. The flows appear to be consistent with short bursts of enhanced reconnection within the plasma sheet, and can transport the plasma between 10 and 30 R sub e earthward or tailward, i.e., the entire distance between the earth and ISEE apogee. The FTE-like structures are also associated with these events. ESA

N88-16602# Imperial Coll. of Science and Technology, London (England). Blackett Lab.
AN UNUSUAL MAGNETOPAUSE ENCOUNTER BY AMPTE-UKS c46
M. A. Saunders, C. J. Farrugia, M. W. Dunlop, W. A. C. Mier-Jedrzejowicz, M. F. Smith, and D. J. Rodgers (Mullard Space Science Lab., Dorking, England) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 131-134 Sponsored by a United Kingdom Royal Society Fellowship (For primary document see N88-16582 08-88)
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High time resolution magnetic field and plasma recordings for a dayside magnetopause encounter by AMPTE-UKS are presented. The magnetopause is crossed twice within 3 min and several prominent magnetic perturbations of period 5 sec are seen within each magnetopause current layer. At times the field points nearly 70 deg to the boundary surface. Accelerated plasma flows occur during the magnetopause encounters. Tearing mode reconnection is the most likely explanation. ESA

N88-16603# Riso National Lab., Roskilde (Denmark).
CONDITIONAL SAMPLING IN PLASMA TURBULENCE c75
H. L. Pecseli and J. Trulsen (Tromsoe Univ., Norway) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 135-138 (For primary document see N88-16582 08-88)
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A conditional statistical analysis of random fluctuations in plasmas is devised to investigate the interaction between particles and plasma waves. It is argued that the conventional correlation analysis is not well suited since it does not discriminate the sign of the potential structures which compose the fluctuating signal. Turbulent electrostatic fluctuations generated by the ion-ion beam

instability are investigated, demonstrating the formation, propagation, and decay of conditional eddies. Analytical relations between the conditional averages and higher order correlation functions are presented. The results are interpreted in terms of phase-space vortices and plasma clump formation. The method allows the extraction of statistically averaged information from multipoint measurements on phenomena occurring randomly in space and time not possible with standard two-point correlation functions. ESA

N88-16604# Kiruna Geophysical Inst. (Sweden). Swedish Inst. of Space Physics.
SMALL SCALE PLASMA DENSITY STRUCTURES OBSERVED BY THE VIKING DOUBLE PROBE INSTRUMENT c75
G. Holmgren, R. Bostroem, G. Gustafsson, and P. M. Kintner (Tromsoe Univ., Norway) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 139-142 Sponsored by the Swedish Board for Space Activities (For primary document see N88-16582 08-88)
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The Swedish Viking satellite measured plasma density in two points in space simultaneously. The separation distance between the two plasma density probes is 80 m. The main aim of this arrangement is to deduce phase velocities for low frequency electrostatic waves. In regions of low wave activity, however, the same technique can be used to study small scale nonperiodic plasma density irregularities. Double probe technique advantages, compared to conventional techniques, are the possibilities to distinguish between temporal and spatial variations, deduction of drift velocities, and distinction between real and spurious signals. Examples of results are shown. ESA

N88-16605# Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Weltraumforschung.
INFLUENCE OF VISCOSITY ON THE STRUCTURE OF A MAGNETIC NEUTRAL LAYER c46
Fausto T. Gratton, Martin F. Heyn, Helfried K. Biernat, Richard P. Rijnbeek, and Graciela Gnavi *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 143-148 Sponsored by the United Kingdom Royal Society (For primary document see N88-16582 08-88)
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An exact solution for the steady state situation in which two counter streaming plasmas (assumed incompressible) carrying antiparallel magnetic fields are brought together to form a stagnation point flow pattern is presented. The solution allows for nonzero values of the magnetic field and a uniform plasma flow at large distances from the current layer. By including viscosity and vorticity, it complements an exact solution of a different type, obtained by Sonnerup and Priest (1975) which assumes potential flow (i.e., zero vorticity). The results of the developed model are compared with observations of the Earth's dayside magnetopause. The model is particularly useful when the interplanetary magnetic field has a southward component. ESA

N88-16606# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
EXPERIMENTAL EVIDENCE OF MICRO-NONEQUILIBRIUM ON THE MAGNETOPAUSE AND FURTHER PREDICTIONS c46
Zhen-jia Wu *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 149-151 (For primary document see N88-16582 08-88)
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A laboratory experiment result which strongly suggests the existence of dawnside micro nonequilibrium on the magnetopause was found. The magnetosphere simulation of Kawashima and Mori (1966) indicates that the solar wind plasma intrudes into the simulated magnetosphere via the morning side of the magnetopause, as predicted by the micro-nonequilibrium theory (Wu, 1986). More predictions are made to accommodate further laboratory tests on the micro-nonequilibrium theory. ESA

N88-16607# Mullard Space Science Lab., Dorking (England).
ION FLOWS IN MAGNETOSPHERIC FLUX TRANSFER EVENTS c46
M. F. Smith, D. J. Rodgers, and M. A. Saunders (Imperial Coll. of Science and Technology, London, England) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 153-158 (For primary document see N88-16582 08-88)
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High resolution data from the AMPTE UK spacecraft of ion flows inside the open flux tube region of magnetospheric flux transfer events (FTE) are discussed. There is reasonable agreement between the observed ion flow direction and the direction expected for the motion of a reconnected flux tube. The size of FTE's and the relevance of the Walen relationship are discussed. There is evidence that the Walen relation is invalid in the core region. ESA

N88-16608*# New Hampshire Univ., Durham. Space Science Center.
SMALL SCALE MHD WAVE PROCESSES IN THE SOLAR ATMOSPHERE AND SOLAR WIND c92
Joseph V. Hollweg *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 161-168 (For primary document see N88-16582 08-88)
(Grants NAGw-76; NsG-7411)
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Solar wind observations suggesting wave-particle interactions via ion-cyclotron resonances are reviewed. The required power at high frequencies is presumably supplied via a turbulent cascade. Tu's (1987) model, which considers a turbulent cascade explicitly, is outlined. In the solar atmosphere, resonance absorption is considered. The meanings of the cusp and Alfven resonances are discussed, and it is shown how energy gets pumped into small scales. It is shown that resonance absorption can heat the corona and spicules in a manner consistent with observations, if turbulence provides an eddy viscosity. ESA

N88-16609# Saint Andrew's Univ. (Scotland). School of Mathematical Sciences.
MHD WAVES IN THE SOLAR ATMOSPHERE c92
P. M. Edwin and B. Roberts *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 169-178 (For primary document see N88-16582 08-88)
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The theory of MHD waves in a magnetically structured atmosphere is outlined. Applications to intense magnetic flux tubes and their solitons, to rapid oscillations in the corona, to spicules, to running penumbral waves, and to helioseismology are made. ESA

N88-16610# Imperial Coll. of Science and Technology, London (England). Blackett Lab.
HYDROMAGNETIC CAVITY EIGENMODES IN A NON-UNIFORM PLASMA c75
D. J. Southwood and W. Allan *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 179-184 (For primary document see N88-16582 08-88)
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The spectrum of hydromagnetic waves excited in a nonuniform bounded cold plasma is discussed. The spectrum is complicated

by the coupling of the two modes found in a uniform plasma, the transverse and fast. The transverse mode is strictly field guided in a uniform plasma. In the nonuniform case, it is restricted to isolated thin magnetic shells, field line resonances, and in practice cannot occur without coupling to fast mode signals excited elsewhere. The field line resonance absorbs energy from the fast mode signal, a process of interest for coronal heating. Cavity eigenmodes of the fast mode are damped by the field line resonance energy absorption. ESA

N88-16611# Uppsala Ionospheric Observatory (Sweden). Swedish Inst. of Space Physics.
LOW FREQUENCY WAVES AND SMALL SCALE SOLITARY STRUCTURES OBSERVED BY VIKING c75
Rolf Bostroem,, Hannu Koskinen, and Bengt Holback *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 185-192 Sponsored by the Swedish Board for Space Activities (For primary document see N88-16582 08-88)
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Low frequency periodic and solitary ion waves observed by Viking in the auroral acceleration region and their interaction with particles are discussed. Electrostatic ion cyclotron waves around the first few harmonics of the gyrofrequency and ion cyclotron harmonic waves around higher harmonics are recorded. The former may be driven by observed beams of upward flowing ions and the latter by the observed atmospheric less cone. Upward propagating solitary waves in the form of localized pronounced plasma density rarefactions and associated electrostatic potential wells are frequently observed. These structures can constitute weak double layers with a net potential drop of up to a volt each. A series of such double layers may contribute to auroral particle acceleration. ESA

N88-16612# Sheffield Univ. (England). Dept. of Physics.
OBSERVATIONS OF SMALL SCALE STRUCTURES USING DATA FROM THE WAVE EXPERIMENT ON THE AMPTE-UKS SPACECRAFT c92
L. J. C. Woolliscroft, C. C. Brown, A. G. Darbyshire, S. N. Walker, P. J. Christiansen, M. P. Gough, A. J. Norris, J. W. LaBelle, R. A. Treumann, and C. Farrugia (Imperial Coll. of Science and Technology, London, England) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 193-198 Sponsored by the United Kingdom Science and Engineering Research Council, the United Kingdom University Grants Committee, and BMFT (For primary document see N88-16582 08-88)
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Data from the wave experiment on AMPTE UKS and IRM spacecraft were used to study small scale phenomena including flux transfer events (FTE) and active current sheets in the solar wind. Results are reviewed to highlight aspects of Cluster scientific studies. Limits of wave experiments are shown. Use of wave data alone is not sufficient to easily distinguish an FTE or magnetic hole from brief magnetopause encounters, or an active solar wind current sheet from bow shock crossings. Thus the most effective event recognition is likely to use data from magnetic field, wave, and plasma instruments for identification, and wave data for timing. ESA

N88-16613# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Space Science Dept.
THE EUROPEAN SPACE PHYSICS ANALYSIS NETWORK
T. R. Sanderson *In its* Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 201-204 (For primary document see N88-16582 08-88)
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A link across the Atlantic was established to connect the US Space Physics Analysis Network (SPAN) to Europe, in support of the encounter between the ICE spacecraft and the comet Giacobini-Zinner. The European SPAN community numbers 70 nodes. In addition, SPAN is connected to the High Energy Physics Network (HEPNET) which has 150 nodes in Europe. Around 1200 computers are connected to SPAN and HEPNET. Development plans of the European SPAN are outlined. ESA

N88-16614# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
ON THE POTENTIAL ROLE OF CONCENTRATED FIELD-ALIGNED CURRENTS IN SOLAR PHYSICS c92
Gerhard Haerendel *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 205-214 (For primary document see N88-16582 08-88)
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The consequences of the existence of intense field-aligned currents on energy storage and dissipation in the solar atmosphere are investigated. Joule heating may be the reason for the chromospheric network as seen in H alpha and for plages in active regions. A wide range of Ohmic dissipation rates can exist without altering the local chromospheric temperature by more than a factor of two. Generation of narrow current tubes by turbulent motions in and below the photosphere could provide the energy to the corona released during flares. The primary energy release during these events could proceed by untwisting of the flux tubes. The high and strongly inhomogeneous pressure distribution set up in the corona as a result of reconnection in multiple narrow current sheets can act as generator of even more intense currents (up to 1000 a/sqm A/m2). They generate the low temperature flare by classical Joule heating of the chromosphere and particle beams greater than 100 MeV by linear acceleration in localized field-aligned potential drops, which may be preferentially set up below the transition region. ESA

89 ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

N88-16615*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CATALOG OF INFRARED OBSERVATIONS. PART 2: APPENDIXES Second Edition
Daniel Y. Gezari, Marion Schmitz, and Jaylee M. Mead Dec. 1987 343 p
(NASA-RP-1196-Pt-2-Ed-2; NAS 1.61:1196-Pt-2-Ed-2) Avail: NTIS HC A15/MF A01 CSCL 03A

The Catalog of Infrared Observations (CIO) is a compilation of infrared astronomical observational data obtained from an extensive literature search of astronomical journals and major astronomical catalogs and surveys. The literature searches are complete for years 1965 to 1986. Supporting appendixes are published in this part. The appendices include an atlas of infrared source positions, two bibliographies of infrared literature upon which the search was based, and, keyed to the main Catalog listings (organized alphabetically by first author, and by date), an atlas of infrared spectral ranges, and IRAS data for the CIO sources. The complete CIO database is available to qualified users in printed microfiche and magnetic tape formats. Author

N88-16616*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THEORETICAL STUDIES OF MASS LOSS AND SHOCK PHENOMENA IN COOL STAR ENVELOPES Semiannual Progress Report No. 8, 1 Apr. - 30 Sep. 1987
Lee Hartmann Feb. 1988 20 p
(Grant NAGw-511)

(NASA-CR-182433; NAS 1.26:182433) Avail: NTIS HC A03/MF A01 CSCL 03A

To show the difficulty of producing the blue-shifted emission of (O I) and (S II) from T Tauri stars directly in the stellar wind, an element of gas in a radially expanding stellar wind was followed as it cooled and recombined. Results indicate that T Tauri winds must be heated at large distances from the star to produce the (S II) emission. A shock between the wind and the disk is an attractive mechanism to produce this heating. When the theory is applied to a simple disk model, a number of predictions and implications are evident, for example, that some T Tauri stars eject mass near the equatorial plane. In a second study, spectral energy distributions of T Tauri stars were analyzed to place limits on the amount of accretion which might occur during the early phase of stellar evolution. The best match to H-alpha line profiles is for models in which the turbulent velocity dominates close to the star, while expansion dominates farther out. Such a model predicts, for instance, that a mass loss rate of 1/10,000,000 solar masses per year is required to account for the blue-shifted Na I absorption of some objects. J.P.B.

N88-15934*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACE INFRARED TELESCOPE FACILITY (SIRTF) DESIGN AND THERMAL ANALYSIS
Jeffrey H. Lee *In* NASA. Lewis Research Center, Cleveland, Ohio. Cryogenic Fluid Management Technology Workshop. Volume 1: Presentation Material and Discussion Sep. 1987 p 193-220 (For primary document see N88-15924 08-34)
Avail: NTIS HC A17/MF A01 CSCL 03A

N88-16139# Joint Publications Research Service, Arlington, Va.
METHOD FOR DETERMINING ATMOSPHERIC TEMPERATURE PROFILES FROM OBSERVATIONS OF ASTRONOMICAL REFRACTION OF STARS Abstract Only
N. A. Vasilenko, K. P. Gaykovich, and M. I. Sumin *In its* USSR Report: Earth Sciences 30 Mar. 1987 p 50-51 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 290, no. 6, Oct. 1986 p 1332-1335 Original language document was announced in IAA as A87-25146 (For primary document see N88-16119 08-42)
Avail: NTIS HC A04/MF A01

N88-16254# Stockholm Observatory (Sweden).
JUSTIFICATION AND PROSPECTS OF OBSERVATIONS OF INTERSTELLAR, FAR-INFRARED EMISSION LINES, USING A SMALL-SIZED BALLOON-BORNE TELESCOPE
H. L. Nordh and S. G. Olofsson *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 329-332 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

N88-16256# Oslo Univ. (Norway). Inst. of Theoretical Physics.
THE EUV LINE FLUX VARIATIONS AND ACTIVITY IN ALPHA ORIONIS
O. Elgaroey, O. Engvold, and P. Joeras *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 337-340 (For primary document see N88-16201 08-46)
Copyright Avail: NTIS HC A21/MF A01

90 ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics.*

N88-16617*# San Diego State Univ., Calif. Dept. of Electrical and Computer Engineering.
PHOTOABSORPTION AND PHOTOTDISSOCIATION OF MOLECULES IMPORTANT IN THE INTERSTELLAR MEDIUM Annual Report, 15 Jan. 1987 - 15 Jan. 1988
Long C. Lee and Masako Sutom 5 Feb. 1988 72 p
(Grant NAGw-319)
(NASA-CR-182435; NAS 1.26:182435) Avail: NTIS HC A04/MF A01 CSCL 03B

The photoabsorption and photodissociation cross sections of interstellar molecules and radicals were measured in the 90 to 200 nm region using synchrotron radiation, F sub 2 laser, excimer lasers, and discharge lamps as light sources. These data are currently needed for determining the formation and destruction rates of molecules and radicals by the interstellar radiation field.
Author

N88-16618# California Univ., Berkeley. Lawrence Berkeley Lab.
AN INTRODUCTION TO NUCLEAR ASTROPHYSICS
E. B. Norman Sep. 1987 24 p Presented at the Latin American School of Physics Conference, La Plata, Argentina, 6 Jul. 1987
(Contract DE-AC03-76SF-00098)
(DE88-002761; LBL-24067; CONF-8707131-1) Avail: NTIS HC A03/MF A01

The role of nuclear reactions in astrophysics is described. Stellar energy generation and heavy element nucleosynthesis is explained in terms of specific sequences of charged-particle and neutron induced reactions. The evolution and final states of stars are examined. DOE

N88-16066# Joint Publications Research Service, Arlington, Va.
FLARE DOUBLET: INTERPLANETARY AND GEOMAGNETIC EFFECTS Abstract Only
K. G. Ivanov, N. V. Mikerina, P. P. Pavlov, and A. F. Kharshiladze *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 55 Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow, USSR), v. 27, no. 2, Mar. - Apr. 1987 p 201-205 Original language document was announced in IAA as A87-42003 (For primary document see N88-16063 08-42)
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N88-16259# Indian Inst. of Tropical Meteorology, Poona.
SOME GROUND-BASED OPTICAL OBSERVATIONS OF COMET HALLEY DURING ITS POST-PERIHELION PASSAGE
P. C. Devara and P. E. Raj *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 351-355 (For primary document see N88-16201 08-46)
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91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.
For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

N88-16619# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio Interplanetario.
AEROSOLS IN MARTIAN ATMOSPHERE AND NATURAL DUST OBSERVATION (AMANDO). PROPOSAL FOR THE MARS ORBITER BALLOON AND ROVER TO STUDY THE MARTIAN ATMOSPHERE, ITS THERMAL CONTENT, AND ITS INTERACTION WITH THE SOIL
V. Formisano Jul. 1987 36 p Prepared in cooperation with Academy of Sciences, Moscow, USSR; ESA, Paris, France; ESA-ESTEC, Noordwijk, The Netherlands; Istituto Universitario Navale, Osservatorio Astronomico, Padova, Italy, Rome, Italy, and Naples, Italy
(IFSI-87-9; ETN-88-91295) Avail: NTIS HC A03/MF A01

A proposal is made to study the Martian atmosphere, its dust (aerosols) content, the influence of dust on the thermal budget of Martian lower atmosphere; variability of suspended aerosols during the day; dust grain mass/size distribution and its variation with altitude (balloon) and dust grain mass distribution as a result of

the interaction between Martian atmosphere and soil. The interaction of Martian soil with the atmosphere is performed by studying the distribution of masses of dust grains for different wind conditions, and for different atmospheric temperatures as expected in day and night. The studies are performed by direct analysis of dust impact pulses generated by piezoelectric ceramics and by a bidimensional charge coupled device (CCD) device working at ambient temperature, looking almost along the local vertical. The influence of the solar wind and the ionospheric currents in the Martian soil can be studied by taking magnetometer measurements from other experiments and performing on board fast Fourier transform to have low frequency wave measurements. ESA

N88-16620*# University of Western Kentucky, Bowling Green. Dept. of Physics and Astronomy.
RAY TRACING OF JOVIAN LOW FREQUENCY RADIATION Final Report
N. Frank Six Dec. 1987 11 p
(Contract NAS8-34424)
(NASA-CR-179262; NAS 1.26:179262) Avail: NTIS HC A03/MF A01 CSCL 03B

The radio emission from Jupiter in the decametric range (2 to 40 MHz) has been studied for three decades. It is known that this emission is correlated with particular longitude regions on the planet and with the position of the satellite Io. The Planetary Radio Astronomy experiment on the Voyager 1 and 2 spacecraft observed this emission, obtaining valuable new information. The objectives of this study are as follows: (1) calculate raypaths for decametric wavelength radiation in Jupiter's magnetosphere; (2) compare the model-dependent raypaths with the Voyager observations; and (3) deduce characteristics of the source regions and the influence of propagation effects. Author

N88-16085# Joint Publications Research Service, Arlington, Va.
APPLICATION OF CORRELATION METHOD OF RECEPTION OF DIRECT AND REFLECTED COSMIC RADIATION TO STUDY OF PLASMASPHERES OF PLANET AND DISTRIBUTION OF RADIATION BRIGHTNESS Abstract Only
D. Ya. Shtern and Ye. A. Garova *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 74 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 332-334 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16086# Joint Publications Research Service, Arlington, Va.
COMPARATIVE ANALYSIS OF ULTRAVIOLET OBSERVATIONS OF HALLEY'S COMET ON ASTRON ASTROPHYSICAL STATION BEFORE AND AFTER PERIHELION Abstract Only
A. A. Boyarchuk, V. P. Grinin, A. M. Zvereva, and A. I. Sheykhet *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 76 Transl. into ENGLISH from Pisma v Astronomicheskiy Zhurnal (Moscow, USSR), v. 13, no. 3, Mar. 1987 p 228-236 Original language document was announced in IAA as A87-42966 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16087# Joint Publications Research Service, Arlington, Va.
MECHANISMS OF CLOUD LAYER FORMATION IN VENUSIAN ATMOSPHERE Abstract Only
Yu. V. Zhulanov, L. M. Mukhin, and D. F. Nenarokov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 77 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 295, no. 2, Jul. 1987 p 330-334 Original language document was announced in IAA as A87-51045 (For primary document see N88-16063 08-42)
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N88-16088# Joint Publications Research Service, Arlington, Va.
ATMOSPHERE OF VENUS IN SOUTHERN POLAR AREA Abstract Only
O. I. Yakovlev, V. N. Gubenko, S. S. Matyugov, G. D. Yakovleva, and I. R. Vaganov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 78 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 258-266 Original language document was announced in IAA as A87-41742 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16089# Joint Publications Research Service, Arlington, Va.
ATMOSPHERE OF VENUS IN SOUTH POLAR AREA BASED ON RADIO TRANSMISSION DATA Abstract Only
O. I. Yakovlev, V. N. Gubenko, S. S. Matgov, and G. D. Yakovleva *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 79 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 267-274 Original language document was announced in IAA as A87-41743 (For primary document see N88-16063 08-42)
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N88-16090# Joint Publications Research Service, Arlington, Va.
ATMOSPHERE OF VENUS IN NORTH POLAR AREA BASED ON RADIO TRANSMISSION DATA FROM VENERA-15 AND VENERA-16 SPACECRAFT Abstract Only
O. I. Yakovlev, S. S. Matgov, A. I. Yefimov, V. N. Gubenko, A. I. Kucheryavenkov, A. S. Vyshlov, and G. D. Yakovleva *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 80 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 275-284 (For primary document see N88-16063 08-42)
Copyright Avail: NTIS HC A08/MF A01

N88-16091# Joint Publications Research Service, Arlington, Va.
PECULIARITIES OF DAYTIME IONOSPHERE OF VENUS DURING YEARS OF LOW AND HIGH SOLAR ACTIVITY Abstract Only
A. L. Gavrik and L. N. Samoznayev *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 81 Transl. into ENGLISH from Kosmicheskiya Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 285-291 Original language document was announced in IAA as A87-41745 (For primary document see N88-16063 08-42)
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DISTRIBUTION OF ELECTRON CONCENTRATION IN NIGHTIME ATMOSPHERE OF VENUS BASED ON RADIO TRANSMISSION DATA Abstract Only
I. K. Osmolovskiy and L. N. Samoznayev *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 82 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 292-300 (For primary document see N88-16063 08-42)
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N88-16093# Joint Publications Research Service, Arlington, Va.
APPLICABILITY OF EXTREMELY LOW FREQUENCY GLOBAL RESONANCES FOR STUDY OF VENUSIAN STORM ACTIVITY Abstract Only
A. P. Nikolayenko and L. M. Rabinovich *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 83 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 301-306 Original language document was announced in IAA as A87-41747 (For primary document see N88-16063 08-42)
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MAGNETIC FIELD OF PLANET URANUS: PREDICTIONS, MEASUREMENTS, INTERPRETATIONS Abstract Only
Sh. Sh. Dolginov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 84 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2,

Mar. - Apr. 1987 p 307-320 Original language document was announced in IAA as A87-41748 (For primary document see N88-16063 08-42)
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DISCOVERY BY VOYAGER-2 OF PREDICTED SATELLITES WHICH DETERMINE RESONANCE NATURE OF URANIAN RINGS Abstract Only
N. N. Gorkavyy and A. M. Fridman *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 85 Transl. into ENGLISH from Pisma v Astronomicheskiy Zhurnal (Moscow, USSR), v. 13, no. 3, Mar. 1987 p 237-244 Original language document was announced in IAA as A87-42967 (For primary document see N88-16063 08-42)
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STUDY OF DESCENT OF PROBES WITH HIGH LIFT-DRAG RATIO INTO THE ATMOSPHERE OF JUPITER Abstract Only
G. M. Lokhov and M. K. Rozhdestvenskiy *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 104 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 193-203 Original language document was announced in IAA as A87-41735 (For primary document see N88-16063 08-42)
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N88-16117# Joint Publications Research Service, Arlington, Va.
PROCESSING OF RADAR IMAGES OF VENUS ON THE MAGISCAN-2 ANALYZER Abstract Only
A. Ya. Danilchenko, M. S. Markov, and M. V. Ostrovskiy *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 137 Transl. into ENGLISH from Geodeziya i Kartografiya (Moscow, USSR), no. 2, Feb. 1987 p 51-55 Original language document was announced in IAA as A87-44303 (For primary document see N88-16063 08-42)
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92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

For related information see *93 Space Radiation*.

N88-16621*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DYNAMIC EVOLUTION OF THE SOURCE VOLUMES OF GRADUAL AND IMPULSIVE SOLAR FLARE EMISSIONS
M. E. Bruner, C. J. Crannell, F. Goetz, A. Magun, and D. L. McKenzie (Aerospace Corp., Los Angeles, Calif.) Dec. 1987 42 p (NASA-TM-87815; Rept-88-B-0077; NAS 1.15:87815) Avail: NTIS HC A03/MF A01 CSCL 03B

This study compares flare source volumes inferred from impulsive hard X-rays and microwaves with those derived from density sensitive soft X-ray line ratios in the O VII spectrum. The data for this study were obtained with the SMM Hard X-Ray Burst Spectrometer, Earth-based radio observatories, and the SOLEX-B spectrometer on the P78-1 satellite. Data were available for the flares of 1980 April 8, 1980 May 9, and 1981 February 26. The hard X-ray/microwave source volume is determined under the assumption that the same electron temperature or power law index characterizes both the source of hard X-rays and the source of microwaves. The O VII line ratios yield the density and volume of the 2 X 10 to the 6th K plasma. For all three flares, the O VII source volume is found to be smallest at the beginning of the flare, near the time when the impulsive hard X-ray/microwave volume reaches its first maximum. At this time, the O VII volume is three to four orders of magnitude smaller than that inferred from the hard X-ray/microwave analysis. Subsequently, the O VII source volume increases by one or two orders of magnitude then remains almost constant until the end of the flare when it apparently increases again. Author

N88-16069# Joint Publications Research Service, Arlington, Va.
MONITORING OF Pc3 PULSATIONS IN SOLAR WIND AND AT EARTH BY INTERPLANETARY MAGNETIC FIELD Abstract Only
O. V. Bolshakova, V. A. Troitskaya, and T. B. Rusakova *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 58 Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow, USSR), v. 27, no. 2, Mar. - Apr. 1987 p 345-346 Original language document was announced in IAA as A87-42038 (For primary document see N88-16063 08-42)
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N88-16070# Joint Publications Research Service, Arlington, Va.
DIPOLE COMPONENT OF RELICT RADIATION DETERMINED FROM RELIKT EXPERIMENT DATA Abstract Only
I. A. Strukov, D. P. Skulachev, M. N. Boyarskiy, and A. N. Tkachev *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 59 Transl. into ENGLISH from Pisma v Astronomicheskiy Zhurnal (Moscow, USSR), v. 13, no. 3, Mar. 1987 p 163-166 Original language document was announced in IAA asA87-42955 (For primary document see N88-16063 08-42)
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SOLAR COSMIC RAY PROPAGATION IN HIGH-VELOCITY SOLAR WIND STREAM Abstract Only
Ye. V. Kolomeyets and V. N. Sevostyanov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 62 Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow, USSR), v. 27, no. 1, Jan. - Feb. 1987 p 12-17 (For primary document see N88-16063 08-42)
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DYNAMICS AND TURBULENCE OF SOLAR WIND IN AREA OF ITS FORMATION BASED ON RADIO TRANSMISSION DATA MEASURED WITH VENERA-15 AND VENERA-16 SPACECRAFT Abstract Only
O. I. Yakovlev, A. I. Yefimov, and S. N. Rubtsov *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 69 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 251-257 (For primary document see N88-16063 08-42)
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QUASIPERIODIC VARIATIONS IN MANIFESTATIONS OF SOLAR ACTIVITY Abstract Only
V. G. Mitrikas, V. M. Petrov, V. P. Okhlovkov, L. S. Okhlopkova, T. N. Charazhyan, and M. V. Zil *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 72 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 325-328 Original language document was announced in IAA as A87-41749 (For primary document see N88-16063 08-42)
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N88-16084# Joint Publications Research Service, Arlington, Va.
SOLAR EVENT OF 27 APRIL 1981 Abstract Only
N. N. Volodichev, B. M. Kuzhevskiy, and O. Yu. Nechayev *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 73 Transl. into ENGLISH from Kosmicheskiye Issledovaniya (Moscow, USSR), v. 25, no. 2, Mar. - Apr. 1987 p 329-331 (For primary document see N88-16063 08-42)
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N88-16257# Oslo Univ. (Norway). Inst. of Theoretical Astrophysics.
ULTRAVIOLET ROCKET-SPECTRA OF A SUNSPOT
P. Brekke, O. Kjeldseth-Moe, J.-D. F. Bartoe, and G. E. Brueckner

(Hulburt, E. O. Center for Space Research, Washington, D.C) *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 341-345 (For primary document see N88-16201 08-46)
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N88-16258# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France). Lab. de Physique Stellaire et Planetaire.
SOLAR ULTRAVIOLET SPECTRUM OBTAINED FROM A BALLOON GONDOLA
D. Samain and P. Lemaire *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 347-350 (For primary document see N88-16201 08-46)
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N88-16276# Observatoire de Paris-Meudon (France). Forecasting Center.
PREDICTION OF THE NEXT SOLAR ACTIVITY CYCLE
P. Lantos and P. Simon *In* ESA, Proceedings of the 8th ESA Symposium on European Rocket and Balloon Programs and Related Research Aug. 1987 p 451-453 (For primary document see N88-16201 08-46)
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N88-16584# Tromsoe Univ. (Norway).
SOLAR CORONA AND SOLAR WIND
Egil Leer *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 11-19 (For primary document see N88-16582 08-88)
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N88-16585# Oslo Univ. (Norway). Inst. of Theoretical Astrophysics.
OBSERVATIONS AND MODELING OF THE PROMINENCE/ CORONA TRANSITION REGION
O. Engvold, O. Kjeldseth-Moe, J.-D. F. Bartoe, and G. E. Brueckner (Hulburt, E. O. Center for Space Research, Washington, D.C) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 21-25 (For primary document see N88-16582 08-88)
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N88-16587# Oslo Univ. (Norway). Dept. of Physics.
INTERPLANETARY AND GEOPHYSICAL EFFECTS OF A CORONAL TRANSIENT
P. E. Sandholt *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 33-38 (For primary document see N88-16582 08-88)
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N88-16591# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France). Lab. de Physique Stellaire et Planetaire.
FLUX TUBES AND LOOPS IN THE SOLAR CHROMOSPHERE AND CORONA
Bernard H. Foing *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 59-63 (For primary document see N88-16582 08-88)
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N88-16597*# Hulburt (E. O.) Center for Space Research, Washington, D.C. Naval Research Lab.
EMERGING FLUX, MAGNETIC RECONNECTION, PLASMA TURBULENCE AND WAVES IN THE TRANSITION ZONE OF THE SOLAR ATMOSPHERE
G. E. Brueckner *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 95-104 (For primary document see N88-16582 08-88)
(NASA Order H-27288-B; NASA Order S-65062-B; NASA Order W-14541)
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N88-16598# Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. of Astronomy.
SMALL-SCALE STRUCTURE IN SOLAR FLARE RADIO EMISSION
A. O. Benz *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 105-108 (For primary document see N88-16582 08-88)
(Grant SNSF-2.019-0.86)
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N88-16599# Katholieke Universiteit te Leuven (Belgium). Inst. of Astronomy.
THE EFFECTS OF VISCOSITY ON RESISTIVE BALLOONING MODES IN LINE-TIED CORONAL MAGNETIC FIELDS
R. VanderLinden, M. Goossens, and A. W. Hood (Saint Andrew's Univ., Scotland) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 109-114 (For primary document see N88-16582 08-88)
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N88-16608*# New Hampshire Univ., Durham. Space Science Center.
SMALL SCALE MHD WAVE PROCESSES IN THE SOLAR ATMOSPHERE AND SOLAR WIND
Joseph V. Hollweg *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 161-168 (For primary document see N88-16582 08-88)
(Grants NAGw-76; NsG-7411)
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N88-16609# Saint Andrew's Univ. (Scotland). School of Mathematical Sciences.
MHD WAVES IN THE SOLAR ATMOSPHERE
P. M. Edwin and B. Roberts *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 169-178 (For primary document see N88-16582 08-88)
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N88-16612# Sheffield Univ. (England). Dept. of Physics.
OBSERVATIONS OF SMALL SCALE STRUCTURES USING DATA FROM THE WAVE EXPERIMENT ON THE AMPTE-UKS SPACECRAFT
L. J. C. Woolliscroft, C. C. Brown, A. G. Darbyshire, S. N. Walker, P. J. Christiansen, M. P. Gough, A. J. Norris, J. W. LaBelle, R. A. Treumann, and C. Farrugia (Imperial Coll. of Science and Technology, London, England) *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 193-198 Sponsored by the United Kingdom Science and Engineering Research Council, the United Kingdom University Grants Committee, and BMFT (For

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N88-16614# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
ON THE POTENTIAL ROLE OF CONCENTRATED FIELD-ALIGNED CURRENTS IN SOLAR PHYSICS
Gerhard Haerendel *In* ESA, Proceedings of the 21st ESLAB Symposium on Small Scale Plasma Processes in the Solar Chromosphere/Corona, Interplanetary Medium and Planetary Magnetospheres Aug. 1987 p 205-214 (For primary document see N88-16582 08-88)
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93 SPACE RADIATION

Includes cosmic radiation; and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N88-16622*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SELF-MODULATIONAL FORMATION OF PULSAR MICRO-STRUCTURES
A. C.-L. Chian (California Univ., Los Angeles.) and C. F. Kennel Sep. 1987 22 p Previously announced in IAA as A84-20602 Submitted for publication Sponsored by CNPq, Brazil (Grant NsG-7341)
(NASA-CR-182420; NAS 1.26:182420; INPE-4394-PRE/1214; PPG-700) Avail: NTIS HC A03/MF A01 CSCL 03B

A nonlinear plasma theory for self modulation of pulsar radio pulses is discussed. A nonlinear Schroedinger equation is derived for strong electromagnetic waves propagating in an electron positron plasma. The nonlinearities arising from wave intensity induced particle mass variation may excite the modulational instability of circularly and linearly polarized pulsar radiation. The resulting wave envelopes can take the form of periodic wave trains or solitons. These nonlinear stationary waveforms may account for the formation of pulsar microstructures. Author

N88-16623# Stanford Univ., Calif.
PRIMORDIAL NUCLEOSYNTHESIS DURING THE keV ERA
S. Dimopoulos, R. Esmailzadeh, L. J. Hall, and G. D. Starkman Sep. 1987 5 p Presented at the American Chemical Society Symposium on Origin and Distribution of the Elements, New Orleans, La., 31 Aug. - 4 Sep. 1987 Prepared in cooperation with California Univ., Berkeley, Lawrence Berkeley Lab.
(Contract DE-AC03-76SF-00098)
(DE88-002233; LBL-23924; CONF-8708165-2) Avail: NTIS HC A02

Energetic hadronic and electromagnetic showers in the keV era of the hot big bang are produced by the decays of long lived particles. These showers initiate a new phase of nucleosynthesis. The abundance ratios of D, He-3, Li-6 and Li-7 are given by fixed points of rate equations, which are determined by nuclear physics not by the nature of the decaying particles. The fixed points are independent of prior abundances, so that constraints from the MeV era of nucleosynthesis evaporate, except for a requirement that He-3 not be underproduced. For example Omega sub Beta = 1 and many more than four neutrino species are both possible. Within the accuracy of our calculation (there are uncertainties of at least a factor of three), the abundances agree with those inferred from observations. Considerable Li3 is produced and must be depleted in both population II halo stars and in the galactic disk. We predict Li-6, He-3, and D abundances in primordial material which are higher than conventional nucleosynthesis. DOE

N88-16065# Joint Publications Research Service, Arlington, Va.
OBSERVATIONS OF GAMMA BURSTS FROM GBS 0526-66
Abstract Only
S. V. Golenetskiy, R. L. Aptekar, Yu. A. Guryan, V. N. Ilinskiy, and Ye. P. Mazets *In its* JPRS Report: Science and Technology. USSR: Space 24 Nov. 1987 p 54 Transl. into ENGLISH from Pisma v Astronomicheskiy Zhurnal (Moscow, USSR), v. 13, no. 5, May 1987 p 406-413 (For primary document see N88-16063 08-42)
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99 GENERAL

No abstracts in this category.

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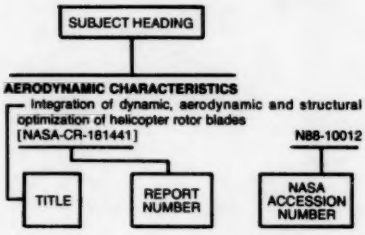

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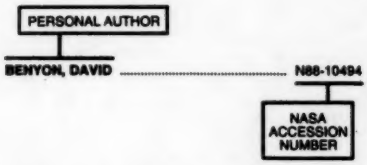

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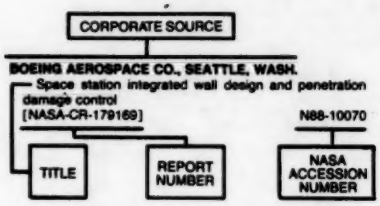

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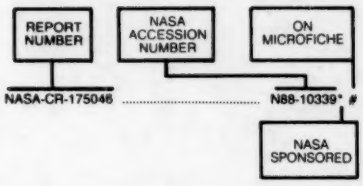

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